ASSIST

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

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Executive summary

One of the main objectives of the policy strategy of the European Union (EU) targeting the years 2030 and 2050 is the establishment of a sustainable but competitive social market economy. The EU faces a greener and smarter economy. This goal is in line with European Transport Policy (ETP) which is described in the new EU Transport White Paper 'Roadmap to a single European Transport Area – Towards a Competitive and Resource Efficient Transport System'. According to the White Paper a transport system is envisaged meeting society's economic, social and environmental needs in a way which is conducive to an inclusive society within a fully integrated and competitive Europe. It suggests a long list of measures and initiatives which could be implemented in the next few decades.

In this context, the ASSIST project was designed to provide the EU with advice on social and economic impacts of sustainable transport policies. Additionally, future challenges for the transport system are taken into consideration in order to identify future needs for transport policies. For this purpose, the ASSIST project followed two main lines of research. The first line consisted of a comprehensive desk research on impact assessment studies and empirical results dealing with social and economic impacts of transport policy measures (TPM). In the second line an integrated assessment model, the ASTRA-EC model, was developed enabling to assess social and economic impacts of TPMs in a quantitative manner. These two lines of research were accomplished by an analysis of the most relevant future challenges and their implications on existing and future TPMs.

After a selection of 61 TPMs of high interest for the European Commission, the ASSIST project developed a 'fact sheet' to structure and allocate the impacts of the TPMs in a comparable and comprehensive way. The fact sheet summarises the findings of the desk research results (quantitatively / qualitatively and compliance with the European policy objectives) of the individual TPMs in a condensed and standardised format. The summary of the considered TPM impact assessment studies yielded comprehensive, reliable and valuable results regarding impacts on the transport system as well as downstream economic, social and environmental impacts. Most impacts have been described qualitatively, some quantitatively. Only very few measures had effects on specific social groups, which do mostly different concern income groups.

With respect to the European policy objectives positive overall effects prevail in the considered impact assessment studies. The assessment showed mainly positive impacts on the economic level. Most TPMs promote an efficient and sustainable transport system, which in turn leads to lower transport costs and thus increases

productivity. Going into detail, the most frequently affected segments are the transport operators, with distinctly positive impacts exerted by the majority of policy measures. Transport costs, sectoral competitiveness and revenues in the transport sector are the most frequently addressed economic impact fields. In general, social impacts on the society as a whole or on groups have been defined in the context of economic and environmental impact assessments. It is obvious that the qualitative and quantitative extent of impacts of individual TPMs strongly depends on the geographical area of implementation (scale), the individual design (e.g. measures within the same TPM category do not necessarily have the same design) and how the measure is supported (financially, politically etc.). As a summary of the assessed impacts of TPMs mostly social groups differentiated by income are affected. With regard to 'safety' and 'health', mostly infrastructure measures have positive effects. The impacts on the environment are even more beneficial and positively related to society. Almost 95% of impacts are environmentally beneficial and thus also let society benefit in a broader sense. The impact fields most (positively) influenced by the selected TPMs concern air pollutants and noise emissions.

ASSIST carried out an analysis of the implications on the transport system and transport policy is made, in order to derive possible policies from the future challenges. The most important challenges with an implication for transport policy are according to the analysis in ASSIST: 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.

Based on literature research the future challenges with strongest implications on the selected TPMs 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.

The identified future challenges affect the transport system and the TPMs in different ways and indirectly 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. 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.

Finally, the need for adapting existing policies in the context of a future challenge was analysed. In some cases, the design of a TPM fulfils today's needs now and requires 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.

The second major objective of ASSIST was the development and transfer of the ASTRA-EC model to the European Commission. ASTRA-EC is an integrated transport, socio-economic and environment model based on System Dynamics methodology. It dynamically simulates the interactions between the model variables between 1995 and 2050 on an annual basis. Thanks to its integrated structure, ASTRA-EC is capable of simulating a wide range of impacts stemming from the application of a transport policy measure. It allows addressing direct impacts as well as second-level and third-level impacts of transport policy measures.

ASTRA-EC can cover economic impacts thanks to a detailed representation of the linkages between the transport sector at the microeconomic level and the macroeconomic level. Social impacts are addressed by ASTRA-EC in two manners. On the one hand, the model provides some indicators related to the social dimensions such as safety (number of accidents, fatalities), accessibility and employment. On the other hand, some results in the transport and economic domain are segmented by income groups. In fact, income distribution itself is modelled in ASTRA-EC, simulating the complex coherences with socio-economic trends on the basis of the age structure of society, educational skills, the dynamics of household structure, employment per sector and the development of the demand and supply side of economies. This differentiation is an important input to simulate passenger transport as income distribution has a visible impact on transport mobility habits.

Therefore, several variables reflecting mobility and consumer patterns in the field of transport are segmented by social groups, differentiating people according to their income, age, gender and household type. This enables to differentiate the reactions of social groups and analyse the social impacts of transport policy, e.g. in terms of transport expenditure by income group as well as mode split or average distance travelled. Using these indicators, it is possible to assess whether policy measures affect social dimensions and whether a particular income group is more or less affected than another one.

A selection of 26 out of the 61 TPMs analysed in the desk research line of ASSIST is implemented in the ASTRA-EC model. On the one hand these TPMs were simulated with the ASTRA-EC model in order to fill existing gaps of the desk research. On the other hand, results in terms of impacts of TPMs collected during the analysis of impact assessment studies and summarised in the online version of the Handbook of Social and Economic Impacts of Sustainable Transport Policies were used to validate the ASTRA-EC model reactions on TPMs. The Reference Scenario against all TPMs are compared is in line with the 2013 PRIMES-TREMOVE Reference Scenario (European Commission 2013). Even if the ASTRA-EC model reactions and the direction of the transport, social, economic and environmental impacts are in most cases similar to those of the browsed impact assessment studies there were differences observed. An example for such a different direction of transport impacts is the TPM *Energy Taxation Directive* (2003/96/EC). ASTRA-EC identified a higher growth of road passenger transport performance than in the Reference Scenario as opposed to the literature. The main reason for this contrary result is the assumption of refunding of additional tax revenues back to private households. Additionally, high taxation of kerosene induces a modal shift from air to rail and road due to increasing air ticket prices. As regards social impacts the TPM affects all income groups but increasing fuel costs and air ticket prices are assessed to mainly hit medium and high income groups. In case that a direction of impacts than in the ex-post analysis could be explained by different model structure, the model reaction was not revised or made in line with the expected impacts from the ex-post analysis.

In most cases, the results of the simulations match the impacts anticipated in the ex-post analysis described in deliverable D2.1. For instance, from the TPM *Internalisation of external costs*, the main effects expected were: some mode shift towards alternatives producing less externalities, an increase of transport costs and some reduction of energy consumption and emissions. These impacts are actually reported by ASTRA-EC, which also highlights the sharp increase of revenues from charging.

1 Introduction

One of the main objectives of the policy strategy of the European Union (EU) targeting the years 2030 and 2050 is the establishment of a sustainable but competitive social market economy. Based on the key drivers of innovation, more efficient resource usage, knowledge-based value growth and last, but not least, the inclusion of the groups of society, a greener and smarter economy is to be achieved. In this context the European Transport Policy (ETP) takes its direction from these general objectives. Therefore, in the new EU Transport White Paper 'Roadmap to a single European Transport Area – Towards a Competitive and Resource Efficient Transport System', the ETP describes its overall aim as establishing a transport system which meets society's economic, social and environmental needs in a way which is conducive to an inclusive society within a fully integrated and competitive Europe. To achieve this aim, a long list of initiatives is given which could be implemented in the next few decades. In addition, EU climate policy has become increasingly important over the past few years and focuses on limiting climate change by setting CO_2 emission reduction targets.

Due to these developments and the future challenges faced by the EU, a sustainable transport policy will have two goals: On the one hand, it should aim at improving the efficiency and competitiveness of the transport system. On the other hand, a sustainable policy has to foster the deployment of innovative and alternative technologies to promote decarbonisation of the transport system.

The ASSIST (Assessing the social and economic impacts of past and future sustainable transport policy in Europe) project, funded by the European Commission (EC) as part of the 7th Framework Research Programme (7FP), aims at supporting the EU in their objectives to develop integrated, greener and smarter transport systems by providing a better understanding of social and economic impacts of transport policies.

The main objective of ASSIST is to provide the EU with sound policy advice on the potential social and economic impacts of future transport policy measures (TPM), which have to be in line with and pursue the strategic objectives of the EU as described above. This overall objective has been achieved by accomplishing the different aims and tasks of ASSIST described below:

1. An assessment and ex-post analysis of the social and economic impacts of 'traditional' TPMs already applied in the EU, specific Member States or other developed countries. Based on desk research, this element forms a main component shaping the policy advice.
2. The consideration of future challenges which constitute significant trend breaks and are expected to occur within the next decades. This involves analysing the

impacts of the challenges (e.g. peak oil, e-mobility) and assessing these impacts compared with the “traditional” TPMs’ social and economic impacts.

3. The development of the ASTRA-EC model, a powerful tool for integrated assessment of medium- and long-term social and economic impacts of transport policies. ASTRA-EC enables the assessment of a number of social impacts. It cannot cover all types of social impacts as some occur only on local level which is beyond the scope of a large scale model at EU27 level. The ASTRA-EC model has been handed over to the European Commission at the end of the ASSIST project.
4. The establishment of communication with stakeholders from the European Commission about the findings of TPM impact assessments and about the use of the ASTRA-EC model.
5. Finally, the compilation and publishing of an online handbook of the social and economic impacts of sustainable transport policies which should be available to a large user community of policymakers and experts from the EC and Member States. The online version of the handbook offers the users different levels of expertise and allows an easier updating and completion by further TPMs in the future.

The ASSIST project had to deal with the social and economic impacts of sustainable transport policy. Of course, the project did not neglect the environmental and institutional dimension of sustainability, but the focus of the project was on social and economic impacts, which in many cases effectively represent the two sides of the same coin. This holds for instance for transport policies which improve at first instance accessibility. Only at second order they provide better access to jobs, culture, leisure facilities, and social impact, but also improve productivity and competitiveness. Finally, they can foster economic development, the economic impact, and employment, which is rather a social impact.

The link between social and economic impacts is not always that straightforward. They are not even heading always in the same direction. In many cases, the social impacts emerge via the environmental impacts. Transport policies that reduce transport-related emissions or noise improve the citizens’ health affected by these environmental impacts. Social impacts deriving from changes of the environmental impacts of transport often exhibit a distributional dimension, i.e. they affect only certain social groups of the population e.g. those living alongside larger roads. Most often the distributional impact is linked to the local nature of environmental impacts like pollution and noise.

The focus of ASSIST was not constrained by classical transport policy measures (e.g. pricing, taxation and infrastructures) such that the wider term of “*Transport Policy Measure*” (TPM) has been introduced. This includes categories like vehicle efficiency standards or research and innovation. Thus, the categories reflect the measures

proposed by the European Transport White Paper which conceives the single European transport area (European Commission 2011).

The assessment of social and economic impacts of TPMs was designed as a twofold process, as both impacts have already occurred in the past and expected impacts of future sustainable transport policies were considered. This meant that ASSIST undertook (1) an ex-post analysis of impacts of existing transport policies, and (2) developed a tool (ASTRA-EC) for prospective analysis of impacts until 2030 and even until 2050. In addition, the analysis was combined with qualitative considerations about the variation of TPMs impacts through changes of the framework conditions given by the socio-economic systems and the environment. We called these changes "*future challenges*"; examples of future challenges affecting transport and TPM impacts include an ageing society, climate change and increase of extreme meteorological events, strongly increasing or very volatile prices of resources, etc.

The basic hypothesis concerning the TPMs impacts was that genuine win-win situations, i.e. situations in which all environmental, social and economic impacts of a TPM would be positive, are rare, so that our assessments in most cases revealed trade-offs between the different impacts or between different social groups or economic actors.

This final report summarises the main findings of ASSIST derived from the three main activities undertaken by the ASSIST project:

- assessing ex-post the social and economic impacts of existing TPMs via desk research,
- analysing the impacts of relevant future challenges on the impacts of TPMs, and
- providing improved tools to quantify social and economic impacts of European policies to foster sustainable transport by developing the ASTRA-EC model.

2 Ex-post analysis of social and economic impacts of TPMs

The main objective of the ex-post analysis is to identify and to quantify as far as possible the potential social, economic and environmental impacts of transport policy measures (TPMs). The respective work package in ASSIST started with the preparation of an overview of the main social and economic impacts of European TPMs. This included environmental impacts as well, if these have a social and economic dimension. Based on a comprehensive desk research for transport policy impact assessment studies, the impacts were collected regarding their influence on the competitiveness of the European transport system and economy. Furthermore, a basis was provided for validating the ASTRA-EC model by quantifying TPM impacts as far as possible. This quantification helped to improve and enhance the ASTRA-EC model. Finally, input for the Handbook of Social and Economic Impacts of Sustainable Transport Policy was prepared, supporting the assessment of the social and economic impacts of sustainable transport policies. This handbook includes a TPM analysis of past effects and future developments to help policymakers, administrations and scientists conduct ex-ante assessments.

The analysis should contribute to provide the EU with sound policy advice on the potential social and economic impacts of sustainable transport policies. It is addressed to policymakers and the interested public and aims to indicate relevant transport policies and outline their impacts. Thus it should be used as a basis for further and more detailed research and not as a substitute for an individual policy assessment.

In general, the second work-package and the report D2.1 provide a chapter which concludes the impact findings of the most important transport European policy measures and their social, economic or ecological effects. The D2.1 does not provide general or even surveying conclusions at any part - in contrast, the work intends to support the handbook and its synthesis. Hence, the synthesis should be considered as the crucial outcome of the assessment of TPM’s and its impacts.

TPM categories, allocation and selection

In order to align the ASSIST impact assessment with the White Paper on Transport, the structure and terminology of the White Paper Impact Assessment (European Commission (2011)) has been largely adopted to allocate the relevant transport policy measures. Accordingly, and based on Maurer et al. (2012), eight categories are defined. These categories are further divided into 41 subcategories, which aim to depict the whole bandwidth of European, national and local transport policy areas.

The eight categories are:

1. Pricing
2. Taxation
3. Infrastructure
4. Internal market
5. Standards and flanking measures
6. Transport planning
7. Research and innovation
8. Others

Measures in the first two categories are designed to influence the demand for transport services and transport infrastructure. The subsequent categories 3 - 7 target the improvement of the supply side of the transport system. In comparison to the White Paper, the scope of the fifth category (efficiency standards) has been expanded slightly by omitting the term “efficiency” because of the diversity of TPMs.

‘Research and innovation’ is not directly comparable with the previous categories in the list as it stands for the fundamental development of transport measures. The final category (‘Others’) subsumes a few TPMs which are not assignable to any of the previous categories.

Selecting TPMs for the impact assessment was based on the requirement that each subcategory must be represented by at least one TPM with the potential to contribute to the main objectives as defined in the White Paper. However, as the work progressed, it became obvious that TPMs often relate to more than one subcategory and can be allocated to different subcategories or even to other categories.

In the end, a “long list” of approximately 180 individual TPMs was compiled from the extensive list of transport measures collected in the first work package. The final selection of TPMs was based on applying a set of criteria (e.g. present political relevance (“hot topic”), spatial level of application, future political relevance etc.) in close cooperation with the EC. These criteria were used to trim the list to the 61 most relevant European transport policy measures.

Impact assessment

Impact assessment is used to identify and analyse the effects and consequences of policies (or projects or programmes) in order to ensure that such measures are:

- economically sound (viable),
- environmentally sustainable, and
- socially equitable.

The ASSIST team developed a “fact sheet” to structure and allocate the impacts of the different transport policy measures in a comparable and comprehensive way. The fact sheet summarises the assessment results (quantitatively / qualitatively and compliance with the European policy objectives) of the individual TPMs in a condensed and standardised format. The subsequent figure illustrates the impact assessment approach within the ASSIST project:

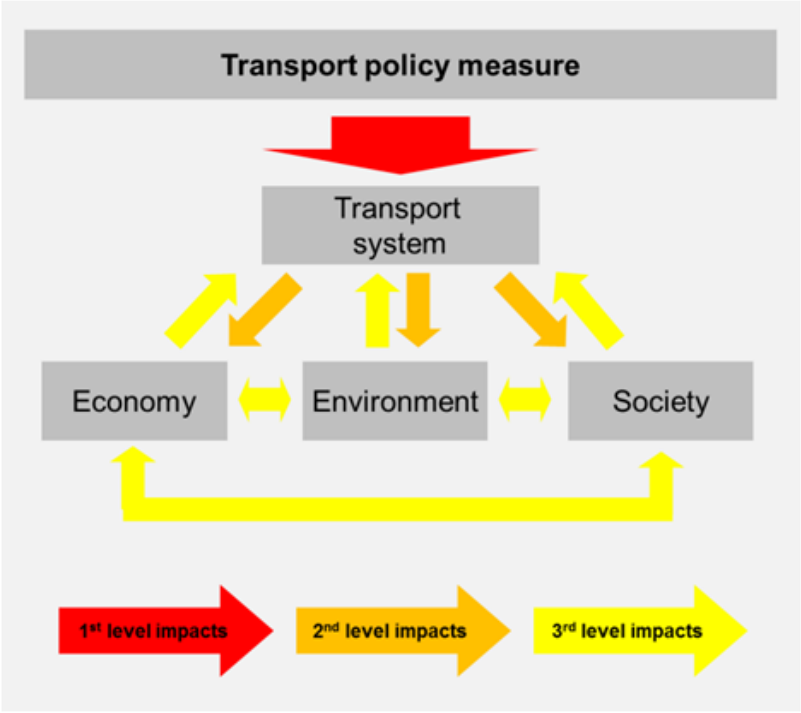


Figure 2-1: Linkages between transport, economic, environmental and social system

Implementing a transport policy measure has multiple effects and consequences (impacts) for different "user" segments (passengers, operators, economy, society etc.) and sections (transport system, economy, environment, society). However, it is expected that all the different types of measures (e.g. infrastructure developments, traffic regulations, fiscal regulations, new vehicles etc.) will first affect the transport system, e.g. by changing user travel times and costs, influencing trip origins / destinations, mode and route choice and finally the traffic conditions (1st level impacts).

At a subsequent stage (2nd level impacts), changes then mainly emanate from the transport system and influence the economy (e.g. due to less congestion, reduced travelling times for transport users and clients, changing transport costs for individuals and firms, improved accessibility for more advantageous location choice for production and commerce), the environment (e.g. reduced air pollution and noise) and society (e.g. due to better health conditions, more acceptable working conditions in transport, easier access to vehicles, better development potentialities of surrounding areas, fewer accidents) with no straight or decisive sequence.

The next impact level (3rd level impacts) describes the impacts on all four sections (the transport system, the economy, the environment and society), irrespective of the direction or kind of action. Hence repercussions on the transport system can occur.

Competitiveness analysis

Greater attention has been paid to competitiveness over the past two decades due to the limitations and challenges posed by globalisation. The EC has also focused more on this issue and has implemented policies to increase competitiveness, both within Europe and between the EU and the rest of the world. A good transport system is essential to increase competitiveness. Competitiveness can be viewed on different levels, like spatial and sectoral level. The spatial level covers the main macro-economic aspects of competitiveness at a regional, national or international level. The sectoral level mainly concerns the micro level, addressing competition between firms or clusters of firms.

ASSIST refers to the definition of competitiveness given by the EC:

'When identifying economic impacts, particular attention should be paid to factors that are widely considered as being important to productivity, and hence to the competitiveness of the EU. Competitiveness is a measure of an economy's ability to provide its population with high and rising standards of living and high rates of employment on a sustainable basis. Vigorous competition in a supportive business environment is a key driver of productivity growth and competitiveness.' (European Commission 2012).

This broad definition covers both **spatial** and **sectoral competitiveness**:

- **Spatial competitiveness** refers to competitiveness on a geographical level like a municipality, region or nation.
- **Sectoral competitiveness** relates to the competitiveness between firms in different sectors like agriculture or industry.

In both cases, competitiveness aims to increase productivity. Obviously, this analysis does not claim to present a comprehensive definition or measurement of competitiveness, but it does try to link the concept of spatial and sectoral competitiveness to the transport system, transport policy and the impacts of transport policy measures.

Spatial competitiveness concerns the improvement of employment and productivity on a certain geographical level, such as a region or a nation. The changes in employment and productivity are benchmarked against other regions or nations. Productivity is dependent upon different factors, such as research and development or foreign direct investments. For a region or nation, good accessibility is a precondition to stimulating employment or economic growth.

Concerning spatial competitiveness, we looked at the impact of categories of TPMs on an area's accessibility. In the transport system, we looked at key variables such as travelling time, distance or costs. A change in any of these variables will bring about a change in accessibility.

The most important TPMs influencing transport costs and hence the accessibility of certain regions are in the categories 'Pricing' and 'Taxation'. Consequently, these TPMs will be considered in the spatial competitiveness analysis. Supply measures such as infrastructure and internal market are also relevant as they usually have a positive effect on accessibility, thus increasing competitiveness in terms of economic growth, productivity and employment. However, some distributional effects may occur as well.

Research and innovation do not lead directly to improved accessibility. However, increasing research and innovation improves the employment situation of this sector. Also, top level research is able to increase the positive public image of a region or nation.

The TPM category 'Other' encompasses very diverse types of measures and their impacts on accessibility can be positive or negative.

Sectoral competitiveness is closely linked with productivity and its fundamental determinants include qualitative and quantitative changes of inputs and technological improvements as well as unit labour costs and price / quality competitiveness. Two different types of sectoral competitiveness have been defined.

- 'Intra-sectoral' changes of competitiveness deal with the structural (modal) shifts within the transportation sector which imply changes concerning the competitiveness of transport operations. If possible, the competitiveness changes influenced by the individual transport policy measure will be explained using the modifications to the variables in terms of cost, time and level of service (reliability, frequency etc.).
- The 'inter-sectoral' level identifies direct and indirect impacts of measures on the competitive preconditions for clustered economic sectors (and services) on a broader scale.

In a holistic consideration of measures and their impacts on competitive aspects, it becomes obvious that positive effects prevail with respect to the general European policy objectives. Although negative intra- and inter-sectoral impacts and effects appear, they do not seriously influence the competitiveness of transport operators and economic sectors.

Secondly, generally it can be stated that transport policy measures affect "intra-sectoral" aspects much more than "inter-sectoral" competitiveness. Furthermore, the analysis revealed that some intra-sectoral transport operators are much more affected by TPMs than others; mostly road and rail transport service suppliers. This is clearly caused by the type (recipient) of measures, which constitute the different categories and its areas of application.

It is evident that the competitiveness analysis is a first attempt to provide insights into the impacts of TPMs. It does not claim to be complete. Further, measure-specific assessments focussing on competitiveness are required, preferably supported by additional quantitative investigations or surveys.

Conclusions

This desk research identified relevant transport policy measures and allocated them to categories and subcategories. The conducted impact assessments reveal that the impacts depend strongly on the type of measure involved. This means that the impact extent of individual TPMs is inevitably related to the geographical area of implementation, the measure's individual design (e.g. measures within the same category do not necessarily have the same design) and the scale/support of measure (financially, politically, spatially etc.). Hence, the assessment results and their use in the ASTRA–EC model as well as in the handbook are general in nature.

The TPM impact assessments yielded comprehensive, reliable and valuable results regarding impacts on the transport system as well as downstream economic, social and environmental impacts. Most impacts have been described qualitatively, some quantitatively. Only very few measures had effects on specific social groups, which do mostly different concern income groups.

Considering the overall result of the impact assessments, it is obvious that positive effects prevail with respect to the European policy objectives. The assessment showed overall positive impacts on the economic level. Most TPMs promote an efficient and sustainable transport system, which in turn leads to lower transport costs and thus increases productivity. Regarding their economic responsiveness (in the sense of being influenced), the most frequently affected segments are the transport operators, with distinctly positive impacts exerted by the majority of policy measures. Transport costs, sectoral competitiveness and revenues in the transport sector are the most frequently addressed economic impact fields.

In general, social impacts on the society as a whole or on groups have been defined in the context of economic and environmental impact assessments. It is obvious that the qualitative and quantitative extent of impacts of individual TPMs strongly depends on the geographical area of implementation (scale), the individual design (e.g. measures within the same TPM category do not necessarily have the same design) and how the measure is supported (financially, politically etc.). The overall assessment of the TPM clearly shows that, if any social groups are affected, these are mostly income groups. The impact assessment reveals that mostly infrastructure measures have positive effects, with regard to 'safety' and 'health'.

The impacts on the environment are even more beneficial and are positively related to society; almost 95% of impacts are environmentally beneficial and thus also benefit society in a broader sense. The impact fields most (positively) influenced by policy

measures concern air pollutants and noise emissions, which are also directly positive for the societal environment

Concerning the impacts mentioned above, a Handbook has been drafted. For different TPMs the *Handbook of Social and Economic Impacts of Sustainable Transport Policies* provides an example on how to assess the transport, social, economic and environmental impacts. It provides a qualitative overview of the TPMs, including a description, references and the different impacts. The impacts can be positive and negative and include a sign whether the impact is going up or down. The Handbook can be found on the ASSIST website[1].

[1] http://www.assist-project.eu/assist-project-en/content/deliverables.php

3 Implications of future challenges on transport policies

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*." (Kiel et al. 2013)

This definition requires some further explanations: 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 could be affected. Second, a trend provides more the idea of some 'natural' movement in one direction, whiles the challenges which are considered to become important by ASSIST, are in several 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 first confronted by the challenges of sustainability. These challenges, environmental, social and economic, involve the crucial questions of energy costs and climate change, but also relate to financial constraints. 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 constrain or even to reduce passenger and goods mobility? What are the consumer behavioural changes which have to be set up to consider all the upcoming challenges?

Several other external challenges can affect the transport system in the future. Most of these challenges are already recognisable (such as globalisation, urbanisation and sprawling, debt), while others can become relevant in the near future (such as diffusion of ICT and migration pressure). Also, there are challenges with longer term issues that nevertheless should be addressed (such as shortage of fossil fuels and 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, references to climate change, fossil fuels shortage, ageing and migratory pressure, globalisation, urbanisation, air and noise pollution are included. The debt problem (both public and private) is at the top of the EU agenda at the time of writing this report.

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 (i.e. making reference to impacts of TPMs), and produced a list of selected future challenges. Challenges may vary in the field behind them, the probability of their occurrence, the scale and the time horizon and they must be relevant with respect to transport policy and its social and economic impacts.

Based upon this approach fifteen relevant challenges were selected (see Table 3-1).

Table 3-1: Selected challenges and the field they belong to

Field	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

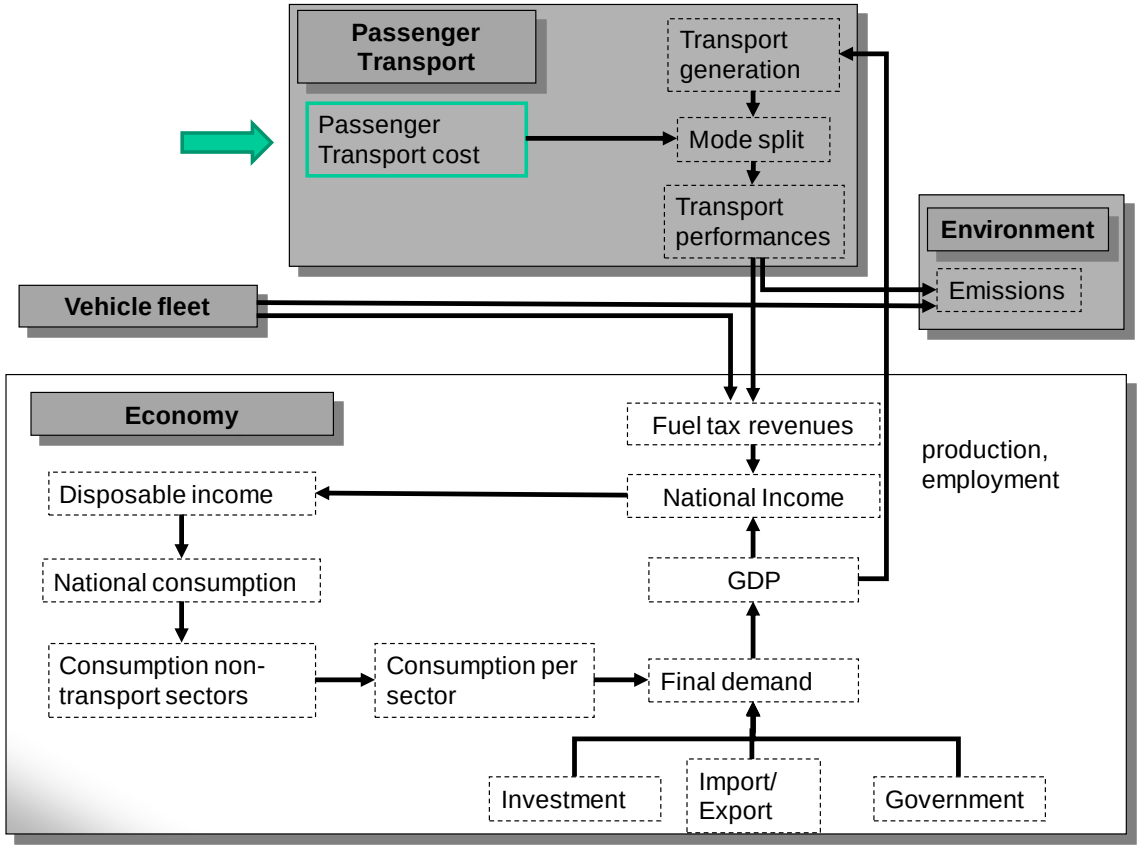
Other challenges were revealed from the analysis as well, with reference to a variety of contexts: e.g. earthquakes and volcanic eruptions, geopolitical conflicts, etc. These other challenges were considered to be less relevant for the purposes of the ASSIST project and were therefore not included in the analysis.

4 Quantification of social and economic impacts with ASTRA-EC

The third major outcome of the ASSIST project is the development of ASTRA-EC: a modelling tool that can be applied for the strategic assessment of transport policy measures in the medium and longer period (up to the year 2050). ASTRA-EC is based on system dynamics methodology which allows simulating the interaction of different elements and their evolution over time. In ASTRA-EC a large number of different elements are represented. Part of them belong to the transport system – e.g. number of trips, tonnes moved, mode split, vehicle fleet – whereas other elements are part of the demographic system (segmented population), the economic system (e.g. GDP, consumption, investment, taxation, trade), the environmental system (energy consumption, emissions) and the social system (employment, accidents). A complex modelling structure links the various elements, also by means of parameters representing technological levels (e.g. emission factors), behavioural attitude (e.g. demand elasticity with respect to cost) and policy environment (e.g. fuel taxation).

Thanks to its integrated structure, ASTRA-EC is capable of simulating a wide range of impacts stemming from the application of a transport policy measure. Making reference to the concepts introduced earlier in this note (see section 2, Figure 2-1), ASTRA-EC can address direct impacts as well as second-level and third-level impacts of transport policy measures. Figure 4-1 provides an example of how the impulse generated by a change of transport cost (e.g. due to different energy taxation) modifies the transport system, propagates to other domains like the economy and the environment and also again gives feedbacks to transport. Fermi et al. (2013) provides a detailed description of the ASTRA-EC modelling approach.

ASTRA-EC can cover *economic impacts* thanks to a detailed representation of the linkages between the transport sector at the microeconomic level and the macroeconomic level. For instance, in the example of Figure 4-1 passenger transport costs are represented in the model at a “micro” level for each transport mode, with energy costs separated by driver costs, fuel taxes explicitly recognised, etc. Changes to some components of the transport costs give rise to a different expenditure for transport, which in macroeconomic terms means different aggregate consumption, which in turns has effects on GDP.



Source: Fraunhofer-ISI - TRT

Figure 4-1: Some effects generated by passenger transport cost variations in ASTRA-EC

ASTRA-EC links the macro-level economic module with the micro-level transport module via so-called *micro-macro bridges* in both directions. An example for such a micro-macro bridge is the bottom-up calculation of fuel tax revenues based on fuel consumption which is a result from passenger transport demand per mode, origin and destination. The main micro-macro bridges modelled in ASTRA-EC concern:

- Passenger transport and sectoral consumption
- Transport and sectoral investment
- Transport and sectoral employment
- Freight transport and total factor productivity
- Transport and intermediate inputs of input-output tables
- Transport and exports.

Social impacts are addressed by ASTRA-EC in two manners. On the one hand, the model provides some indicators related to the social dimensions such as safety (number of accidents, fatalities), accessibility and employment. On the other hand, some results in the transport and economic domain are segmented by income groups.

In fact, income distribution itself is modelled in ASTRA-EC, simulating the complex coherences with socio-economic trends on the basis of the age structure of society, educational skills, the dynamics of household structure, employment per sector and the development of the demand and supply side of economies. This differentiation is an important input to simulate passenger transport. Krail (2009) confirms this by analysing mobility surveys. The analysis demonstrates that income distribution has a visible impact on transport mobility habits.

Therefore, several variables reflecting mobility and consumer patterns in the field of transport are segmented by social groups, differentiating people according to their income, age, gender and household type. This enables to differentiate the reactions of social groups and analyse the social impacts of transport policy, e.g. in terms of transport expenditure by income group as well as mode split or average distance travelled. Using these indicators, it is possible to assess whether policy measures affect social dimensions and whether a particular income group is more or less affected than another one.

ASTRA-EC user interface

One of the key features of the ASTRA-EC model is its user interface. The interface has been developed to enable accessing the model by all type of users (including non-modelling experts). They should be able to explore the model structure, to carry out simulations by changing model parameters (e.g. transport pricing, car prices), to read results and to compare different single policy scenarios and policy packages.

The interface is developed using the internal Vensim® language. It consists of three main parts, concerning:

- the structure of the ASTRA-EC model,
- the inputs to set up the simulation of transport policies and scenarios,
- the outputs of a simulation.

In the first part the user can access a set of graphical schemes representing the structure of each module (transport, population, vehcile fleet, etc.), in order to represent the key variables, linkages and feedbacks. In the second part the user can set values

for several leverages in order to simulate single transport policies or policy packages. In addition, the interface allows simulating scenarios with different sets of exogenous assumptions (e.g. external cost, emission factors, etc.).

Finally, the ASTRA-EC interface allows reading and interpreting the outcome of the simulation of a given scenario. The user can have a close look at results for selected key outputs in the fields of transport, economy, society and environment over the whole simulation period. He can compare with the interface the results of different policy scenarios in order to evaluate potential impacts.

Validation of ASTRA-EC

A crucial step towards an impact assessment model producing reliable results for transport policy measures is a comprehensive calibration and validation of key indicators. Validation can be understood as the process to enable the reproduction of trends of a model. ASTRA-EC has been calibrated such that endogenously calculated key transport, social, economic and environmental indicators fit to the observed development of these indicators in real world for the period from 1995 to 2010.

Due to the integrated model structure ASTRA-EC considers not only causal relations within the transport system. It further includes linkages with the socio-economic system, the environmental system as well as with technology diffusion. This makes ASTRA-EC an integrated modelling approach. Hence, it is a tool enabling endogenous forecasts sensitive to key determinants. Nevertheless, ASTRA-EC as a decision-support tool needs to follow at least major trends simulated by other impact assessment models. Results of model-based policy impact assessments can only be compared if the framework is consistent. Therefore, trends for major transport, economic and social indicators in ASTRA-EC from 2010 to 2050 have been made in line with the 2013 Reference Scenario from PRIMES-TREMOVE (European Commission 2013). GDP, population, passenger and freight transport performance as well as car fleets are in line with PRIMES-TREMOVE (see Krail et al. 2013). Marginal differences have to be accepted due to the need for internal consistency of the model. E.g. under consideration of improving load factors, the growth of truck vehicle fleets needs to be lower than road freight transport growth.

GDP in real terms increases by +1.6% annually in EU27 from 2010 to 2050 (see Table 4-1). The impacts of demographic change in EU27 are visible via differing economic growth from until 2030 and beyond 2030. Today, every 5th person in EU27 is above 60 years old. Even under the optimistic assumption that people migrating towards EU27 are mainly between 15 und 44 years old, the problem of ageing societies becomes

clear. In 2050 on average every third inhabitant of EU27 will be above 60 years old. Potential labour force will decrease from 60% to 50% until 2050.

Table 4-1: Major economic trends in the ASTRA-EC Reference Scenario

Region	Indicator	Indicators in bn €$_{2005}$ / Mio pers.			Annual Growth in %	
		2010	2030	2050	2010-'30	2030-'50
EU27	GDP	11,245	16,184	21,080	1.8%	1.3%
	Consumption	4,981	7,302	9,705	1.9%	1.4%
	Investment	1,662	2,563	3,172	2.2%	1.1%
	Employment	219.3	219.9	214.7	0.0%	-0.1%
	Trade Balance	1,174	1,898	2,727	2.4%	1.8%

Source: ASTRA-EC

The transport trends in the Reference Scenario are those provided by the PRIMES-TREMOVE model. In the EU27, passenger transport activity is expected to grow until the year 2050 but with a descending rate (Table 4-2). In the first half of the forecasting period (i.e. between 2010 and 2030) the expected growth rate is +1.1%. In the second half – between 2030 and 2050 – the expected growth rate falls to +0.7%. Different trends by mode of transport are expected. Rail and air transport are projected to grow more than other modes. Forecasted air growth rates are +2.7% per year until 2030 and +1.6% from 2030 to 2050. Rail trend is still over the average but more moderate: +1.8% per year until 2030 and +1.1% afterwards. Road modes, car and bus, are instead expected to grow less than the average.

Table 4-2: Passenger and freight transport demand (Gpkm and Gtkm) and average growth rates per year in the ASTRA-EC Reference Scenario

Indicator	2010	2030	2050	2010/30 per year	2030/50 per year
Passenger-km	6268	7729	8889	1.1%	0.7%
Ton-km	3652	5044	5772	1.6%	0.7%

Source: ASTRA-EC

ASTRA-EC estimates a growth of freight demand by +1.6% per year until 2030 and +0.7% per year from 2030 to 2050 in the EU27. Unlike the passenger case, growth rates by mode are quite similar especially after the year 2030. Only from 2010 to 2030 rail freight is expected to grow significantly more than other modes (2.2% per year).

TPM impact assessment with ASTRA-EC

A selection of 26 out of the 61 TPMs analysed in the desk research line of ASSIST is implemented in the ASTRA-EC model. After the validation of the ASTRA-EC model in order to provide a Reference Scenario in line with the 2013 Reference Scenario from PRIMES-TREMOVE, the ASTRA-EC model reactions on the selected TPMs were evaluated. A comparison between expectations on impacts in the different fields (society, economy, transport and environment) derived from the ex-post analysis in the ASSIST deliverable D2.1 (Kritzinger et al. 2013) and the ASTRA-EC model reactions was used to validate the ASTRA-EC model where appropriate. Nevertheless, ASTRA-EC identified for some TPMs different direction of impacts than those collected in the factsheets. An example for such a different direction of transport impacts is the TPM *Energy Taxation*. As opposed to the literature used for preparing factsheets in deliverable D2.1 ASTRA-EC identified a higher growth of road passenger transport performance than in the Reference Scenario. The main reason for this contrary result is the assumption of refunding of additional tax revenues back to private households. Additionally, high taxation of kerosene induces a modal shift from air to rail and road due to increasing air ticket prices. As regards social impacts the TPM affects all income groups but increasing fuel costs and air ticket prices are assessed to mainly hit medium and high income groups. In case that a direction of impacts than in the ex-post analysis could be explained by different model structure, the model reaction was not revised or made in line with the expected impacts from the ex-post analysis.

Another difference in the direction of impacts could be identified for the TPM *Electromobility Road* in the category *Research and Innovation*. Assuming higher learning rates for battery and hybrid electric vehicles (BEV, PHEV and HEV), additional investments in R&D to increase reliability of EVs, the build-up of a charging infrastructure and promotion of EVs ASTRA-EC assesses an increase of passenger-km for cars. The boosting effect of investments on the economy, lower costs of operation for EVs and an accelerated diffusion of EVs in EU car fleets lead to this effect. Even if purchasing prices for EVs are today significantly higher than for conventional fossil fuel cars, they are even today for a large number of driving cycles beneficial due to lower energy costs per driven km. Higher shares of EV induce lower average costs for car mode which impacts modal shift such that modal share of cars increases as opposed to ex-post assessment results.

In most cases, the results of the simulations match the impacts anticipated in the ex-post analysis described in deliverable D2.1. For instance, from the TPM *Internalisation of external costs*, the main effects expected were: some mode shift towards alternatives producing less externalities, an increase of transport costs and some

reduction of energy consumption and emissions. These impacts are actually reported by ASTRA-EC, which also highlights the sharp increase of revenues from charging.

Another example for matching directions of impacts is the TPM *EU-wide common job quality and working conditions for truck drivers*, the ASTRA-EC results confirm the expected impact in term of higher transport costs (and also transport times, which is however an input for the model rather than an outcome of the simulation). ASTRA-EC adds a slightly negative impact on the economic growth because of the influence of increasing freight transport generalised cost (i.e. including travel time) on technical progress reflected by Total Factor Productivity in the economic module of ASTRA-EC.

One of the anticipated effects of setting restrictive *CO_2 emissions limits* for new road vehicles (cars, LDVs and HDVs) was an increase of traffic because of lower transport costs for road modes. Furthermore, a reduction of emissions and some more economic growth and employment is expected. ASTRA-EC results are in line with such effects, even if the increase of demand is limited (total transport activity is not augmented, but there is a shift towards road modes) as well as the economic impact (especially on employment).

Finally, according to deliverable D2.1, the TPM *City logistics* is expected to have positive impacts on transport by reducing travel costs and times, less road traffic (and therefore improved travel times) and lower emissions. The ASTRA-EC simulation results for this TPM confirm these impacts except for travel time. Travel time impacts cannot be identified in that detail as ASTRA-EC does not contain a network-based transport model.

5 Handbook of Social and Economic Impacts of Sustainable Transport Policy

Another main objective and a major “product” of the ASSIST project is to compile and publish a *Handbook of Social and Economic Impacts of Sustainable Transport Policy***.** This handbook is addressed to a large user community of policymakers and experts from the EC and Member States. The handbook is accessible via the ASSIST website[2]. It includes a TPM analysis of past effects and future developments to help policymakers, administrations and scientists conduct ex-ante assessments. The following chapter describes the structure and broad setup of the handbook and renders assistance on how to “read” it.

The handbook is based on the desk research carried out for deliverable D2.1 As a first step for developing the handbook, work package 2 (WP2) targeted to identify the potential social, economic and environmental impacts of transport policy measures, which are based on sustainability criteria, by conducting an impact assessment by means of so called “fact sheets”.

The assessment not only looks at direct impacts, but at all sorts of indirect effects, both short-term and long-term. Indirect impacts on different social groups (e.g. by age, gender, income level, physical status etc.) are also relevant to ASSIST.

Each policy measure is assessed according to four impact fields: the transport system, the economy, society and the environment, delivering input for the handbook to support the assessment of the social and economic impacts of sustainable transport policies.

Concept and setup of the handbook

The structure of the handbook and its setup is closely related to the approach of the impact assessment compiled by the fact sheets. Each fact sheet consists of three main parts:

First Part - General Information

The first part identifies the selected TPM by title, policy category and subcategory. The TPM is described in summarised text form. The policy background and objectives are mentioned, complemented by implementation examples if applicable, such as the

2 http://www.assist-project.eu/assist-project-en/content/fact-sheet-list.php

national implementation of EU legislation or specific implementation projects. This part also provides an overview, in qualitative terms, of the intended key changes regarding traffic and transport.

Second part - Impacts

The second part is the main part of the handbook. In four sections, the various impacts triggered by the TPM are documented in a formally structured way with supporting verbal summaries. The impacts are labelled in compliance with the terminology used in the impact assessment guidelines published by the European Commission [SEC (2009)92 final]. Methodologically, four categories of impacts are distinguished:

- Traffic impacts:

  As TPMs are essentially intended to influence the transport sector, the impacts on all parties in this sector are reported first. The main impact fields are travelling time, risk of congestion, vehicle mileage and service and comfort.

- Economic impacts:

  They are regarded as primarily relevant at the micro-economic level such as transport costs, revenues for transport operators and public authorities or changes in the value of real estate (triggered by improved accessibility or negative environmental impacts like noise). It also considers the competitiveness of the transport industry sectoral and spatial competitiveness.

- Social impacts:

  When looking at the social side of TPMs, the handbook focuses on impacts on safety, health, employment and accessibility to transport systems. Social impacts describe the extent to which TPMs influence the societal structure – do they help to reduce differences or do they aggravate social disparities?

- Environmental impacts:

  The handbook is not intended to replace a full environmental impact assessment, but it does emphasise the main environmental impacts with social relevance affected by the respective TPM.

All the impacts are presented in a standardised grid distinguishing the various groups affected. If impacts are judged to be relevant, the position of an arrow shows the change caused by the TPM in a simplified quantitative way. The underlying colour of the box indicates whether this change is positive (blue) or negative (red) referring to the policy aims of the White Paper. Impacts vary significantly between implementation and operation phase, which are reported in two separate lines.

Segments

The *columns* in the handbook mainly comprise the groups of persons / companies, which are directly and indirectly affected by one or more impacts of the specific TPM.

Overall, there are 16 different segments possibly affected by the implementation of a TPM, main segments allocated to two major groups: *passengers (transport users)* and *transport operators (service providers)*. The latter represent the companies supplying transport services including both passenger and freight transport. Subsequently Table 5-1 further divides these main groups according to the relevant modes of transport concerned.

Table 5-1: Differentiation of affected groups by mode of transport

Mode	Passengers	Transport operators
Road	Car drivers, motorcyclists; car and motorcycle passengers	Road hauliers (freight)
Rail	Rail passengers	Railway companies (for passenger and freight)
IWW (inland waterways)	negligible	Barge operators, inland port authorities (freight)
Air	Airline passengers	Air carriers, airport authorities (passengers and freight)
Maritime	Not covered	Ship-owners, seaport authorities (freight)
Public transport	Bus, coach and light rail passengers	Public transport operators (passengers)
Slow modes	Pedestrians, cyclists and other non-motorised forms of transport	Negligible

Source: ProgTrans

In addition to passengers and transport operators, other “user” segments considered in the handbook are:

- *Employees in the transport sector*

  Employees are those persons working in the transport sector and potentially affected by a TPM.

- *Residents*

  Residents are directly affected by TPM impacts like noise, emissions or changes in the value of real estate caused by transport systems.

- *Economy*

  “Economy” is regarded as a directly and indirectly affected broad reservoir of users such as companies, employees, markets etc. Economy covers businesses and branches not belonging to the transport sector. These benefit from a better (or worse) accessibility, higher or lower turnovers or changes in the value of their real estate.

- *Public bodies*

  Public bodies are, depending on the geographical level of the TPM, either local, regional, national or European authorities or agencies. The impacts are primarily linked to taxes, revenues or impacts on long-term financial obligations for infrastructure investments and operation.

- *Society*

  Society mostly encompasses environmental and economic impacts which are not directly assignable to a specific group. Additionally, in some cases there may be opposing impacts on different groups depending on whether society as a whole profits from the transport policy measure.

6 Conclusions

The intention of the ASSIST project was to develop a comprehensive approach for assessing social and economic impacts of transport policies and to set a new state-of-the-art. The ex-post analysis of TPMs selected with reference to the Transport White Paper of 2011 developed a compendium of existing knowledge on economic and social impacts differentiated into impact on transports modes, spatial impact and impacts on certain population groups. The analysis revealed that in general social impacts could be improved by the White Paper policies at the European level. However, at the local level this conclusion would not always be appropriate, as social impacts may also be negative. In general it emerges that it lacks both the European tools to assess the social impacts and, most often, the European responsibility to mitigate the impacts due to the subsidiarity principle.

An important outcome of ASSIST is to point to the potential difference between impacts of the same transport policy in the past and in the future. This difference emerges because (some) of the future challenges becoming reality and thus changing the framework conditions for transport policies. Obvious examples of these challenges would be ageing, with different age groups having different vehicle ownership and mobility patterns, or strongly increasing crude oil prices, causing other mode choices, income inequalities and a tendency towards fuel efficient vehicles. To further explore the TPMs and future challenges, we refer to the ASSIST website (www.assist-project.eu) for an overview of the social, economic and environmental impacts of different TPMs.

A suitable tool to consider these changing framework conditions is the ASTRA model, as it enables the implementation of scenarios over time, i.e. scenarios with changing trends of oil prices, population structure, technology features, etc. The newly developed ASTRA-EC model enables quantitative assessment of economic, social and environmental impacts, though it must be clearly said, that the full picture of impacts can still not be provided. Indeed, the capabilities to quantify economic impacts (e.g. in terms of gross domestic product, valued added, investment or exports) can better be tackled by the ASTRA-EC model than the social impacts, for which only a few like employment or the distributional effects on different income groups could be reflected. As concerns economic impacts of transport policies ASTRA-EC enables a holistic impact assessment. This means that the policies can be differentiated according to their time path. Furthermore, ASTRA-EC takes costs of a transport policy for users, state and companies as well as the revenues and their use into account. This is crucial for a comprehensive economic and social impact assessment as it can change results significantly. Another value-added of the integrated dynamic model structure of

ASTRA-EC is that rebound effects can be identified. This can provide the necessary information for a redesign of TPMs in order to compensate or avoid non-intended rebound effects.

In general, the ASSIST project made good progress in assessing the social and economic impacts of past and future sustainable transport policy in Europe, but it still leaves room for improvement of the quantitative assessment tools as well as for qualitative approaches to describe and consider, in particular the social impacts of European transport policy-making.

The ASSIST project has revealed that social impacts of transport policy measures need more attention. The quantification of these impacts is still a weak point. The Handbook of Social and Economic Impacts of Sustainable Transport Policies[3] shows different examples of TPMs where the social impacts could only be assessed in a qualitative way. Further investigations into the social impacts are needed to get a better grip on these impacts, taking them into account in assessments.

While assessing transport policy measures, the Handbook provides a guideline on how to assess the different impacts. It structures thinking about the impacts. Nevertheless the Handbook needs to be considered as a current draft covering in a comprehensive way today's knowledge about social, economic and environmental impacts of transport policies. As the design of transport policies will change or even new transport policies will need to be developed matching the needs of upcoming challenges, the Handbook needs to be revised in the future accordingly. This can also be done by adding findings of impact assessment studies of further TPMs or by external audits on the covered TPMs in the different categories. This will keep the Handbook a living document and increase the value-added as a tool for decision-support of policy-makers.

One of the findings of ASSIST is that the degree of quantifying social impacts of TPMs on European level is limited. Social impacts of TPMs are multi-fold with winners and losers on different spatial level. ASTRA-EC could provide valuable information about impacts on European or country level. In order to identify social impacts on local level a linkage of ASTRA-EC together with a micro-level model could be a solution to overcome this gap in social impact assessment.

The modelling approach of ASTRA-EC allows the linkage to network-based assignment models. While ASTRA-EC suits perfectly for the assessment of pricing or

[3] http://www.assist-project.eu/assist-project-en/content/fact-sheet-list.php

taxation policies, impact assessment of infrastructure policies like in the context of TEN-T has constraints. A combination of ASTRA-EC with a network-based assignment model can help to overcome this constraint and would allow a comprehensive social and economic impact assessment even of single transport infrastructure measures.

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Annex – Illustrative TPM fact sheet “Eurovignette”

ASSIST - Assessment of social and economic impacts of transport policy measures

Workpackage 2: Transport Policy Measure Impact Assessment

FACT SHEET NO.: 1 / 1 **PERFORMED BY: NEA**

A GENERAL INFORMATION

A 1	**Category**	**Pricing**
A 2	**Subcategory**	**Infrastructure charging**
A 3	**Transport policy measure (TPM)**	**Eurovignette**
A 4	**Description of TPM**	Problem: To ensure cost transparency regarding road usage and external costs of road freight transport. 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. **Directive 1999/62/EC, Directive 2006/38/EC and Directive 2011/76/EU** recommend the introduction of tolls in all EU countries, requiring hauliers to pay when travelling in the interurban high capacity roads and main roads. The original framework prevented governments from charging trucks for their impact on the environment. **The revision of the "Eurovignette" directive in 2011** introduces the internalisation of external effects. Hence, member states may charge road freight transportation which implements respectively calculates the costs of air and noise pollution peak respectively off-peak. To this end, member states may apply an "external cost charge" on lorries, complementing the already existing infrastructure charge designed to recover the costs of construction, operation, maintenance and development of road infrastructure.
A 5	**Implementation examples**	**Example Germany:** - Modification (increase) of the toll rates per Jan 2011 - Increase in infrastructure investments (especially for arterial roads/highways) - Incentive for carriers to refit their fleet by more environmentally friendly vehicles (Euro-5 lorries are exempt from air pollution charges until 2014 and Euro-6 until 2018): subsidies of ca 100 million EUR/year by Germany government
A 6	**Objectives of TPM**	By laying down common rules on how EU states may charge heavy goods vehicles for using the road network, the 'Eurovignette' directive aims to: - to ensure national toll systems reflect the 'external costs' of transport, including environmental damage, congestion, and accidents (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 (rail, inland waterways) - reduce pollution from road freight transport and making traffic flow smoother by levying tolls that factor in the cost of air and noise pollution due to traffic and help avoid road congestion.
A 7	**Key changes concerning:**	
A 7.1	- Choice of transport mode / Multimodality:	Increasing costs for road transport may possibly make rail and IWW more attractive.[16] Likely increase of multimodal transport usage / chains
A 7.2	- Origin and/or destination of trip:	The directive is not likely to influence the location choice for production or consumption
A 7.3	- Trip frequency:	Reduction of trip frequencies e.g. through more efficient organisation of freight transport
A 7.4	- Choice of route:	The directive positively influences the route choice (e.g. avoiding more expensive routes such as Alpine area)
A 7.5	- Timing (day, hour):	Reduction of peak travels due to higher charges (maximum variation rate of 175 % during peak periods limited to five hours per day).
A 7.6	- Occupancy rate / Loading factor:	Increasing load factor; in the example of the Paris-Amsterdam corridor an increase of payload by 11% was identified [16]
A 7.7	- Energy efficiency / Energy usage:	No impact
A 8	**Main source**	[1] Eur-lex: Directive 2006/38/EC amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures (17 May 2006) [FR] [DE]

B IMPACTS

B 1 OVERVIEW ON IMPACTS

		AFFECTED SEGMENTS															Geographical level		Source	
		Passengers					Transport operators													
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	1st level	2nd level	Source of assessment	Spatial level of source
B 1.1	**Summary**																	N	I	S	I
	The Eurovignette directive concerns freight transport on mainly inter-urban links. Therefore the main group which is affected are transport operators (shippers, carriers) who have to bear the additional cost, especially when they cannot switch to other modes																			
B 1.2	**Summary: Income groups**	No impact																			
B 1.3	**Summary: Age groups**	No impact																			
B 1.4	**Summary: Disabled people**	No impact																			
B 1.5	**Summary: Gender groups**	No impact																			
B 1.6	**Summary: Ethnic groups**	No impact																			

B 2 TRAFFIC IMPACTS

		AFFECTED SEGMENTS															Geographical level		Source	
		Passengers					Transport operators													
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	1st level	2nd level	Source of assessment	Spatial level of source
B 2.1	Travel or transport time						↘											N	R	E	
B 2.2	Risk of congestion						↘											N	R	E	
B 2.3	Vehicle mileage						↘	↗	↗									N	R	S	N
B 2.4	Service and comfort						↗											N	R	E	
B 2.I	**Overall impacts on social groups**																				
B 2.II	**Implementation phase**																				
B 2.III	**Operation phase**	Impact as soon as directive comes into effect																			
B 2.IV	**Summary / comments concerning the main impacts**	- Decrease of HGV mileage, travel and transport time - Improvement of road service/comfort and freight transport on other modes																			
B 2.V	**Quantification of impacts**																				

B 3 ECONOMIC IMPACTS

		AFFECTED SEGMENTS															Geographical level		Source	
		Passengers					Transport operators													
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	1st level	2nd level	Source of assessment	Spatial level of source
B 3.1	Transport costs						↗											N		S	I
B 3.2	Private income / commercial turn over												↘					L	R	E	I
B 3.3	Revenues in the transport sector						↘											L	R	S	I
B 3.4	Sectoral competitiveness						↘	↗	→						↘			L	R	E	I
B 3.5	Spatial competitiveness														↘			N	I	E	I
B 3.6	Housing expenditures																				
B 3.7	Insurance costs																				
B 3.8	Health service costs																				
B 3.9	Public authorities & adm. burdens on businesses						↗						↗			↗		L	R	E	
B 3.10	Public income (e.g.: taxes, charges)															↑		N	R	S	N
B 3.11	Third countries and international relations																				
B 3.I	**Overall impacts on social groups**																				
B 3.II	**Implementation phase**	High costs for implementation: A projection for the EU 27 results in equipment costs of EUR 33 bn. E.g. the German toll system caused EUR 1.24 bn costs, the Austrian system EUR 750 million [17]																			
B 3.III	**Operation phase**	The operational depend on the way of implementing the charge. The range of operation costs as percentage of total revenues varies in existing toll systems like in Austria, Czech Republic, Poland (all Dedicated Short Range Communication Systems), Germany, Slovakia and as planned for France (all Global Navigation Satellite Systems) between 10% and 20%. [17]																			
B 3.IV	**Summary / comments concerning the main impacts**	- Increase in transport costs for the road haulage industry; benefits for the road and other land-based infrastructure - Transport operators: road transport users have to carry the financial burden of the toll; on the other hand they benefit from less congestion and time savings; transport users from other modes (rail and IWW) may benefit from a cross-financing of their infrastructure - Positive contribution to spatial competitiveness on a regional level: authorities may decide to exempt isolated areas or economically weak regions from applying tolls or user charges - Negative effects on competitiveness of poorer countries and on EU territorial cohesion: peripheral poorer countries pay more to richer countries; export-oriented countries and small countries pay more because they make greater use of the infrastructure of neighbouring countries. Countries which are located more centrally within Europe will have more positive balances between received and paid tolls. [15]																			
B 3.V	**Quantification of impacts**																				

B 4	SOCIAL IMPACTS	AFFECTED SEGMENTS																Geographical level		Source	
		Passengers					Transport operators														
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	1st level	2nd level	Source of assessment	Spatial level of source
B 4.1	Health (incl. well-being)																↗	N	L	E	
B 4.2	Safety																				
B 4.3	Crime, terrorism and security																				
B 4.4	Accessibility of transport systems																				
B 4.5	Social inclusion, equality & opportunities																				
B 4.6	Standards and rights (related to job quality)																				
B 4.7	Employment and labour markets																				
B 4.8	Cultural heritage / culture																				
B 4.I	**Overall impacts on social groups**																				
B 4.II	**Implementation phase**																				
B 4.III	**Operation phase**																				
B 4.IV	**Summary / comments concerning the main impacts**	**Positive contribution to social cohesion on a regional level:** authorities may decide to exempt isolated areas or economically weak regions from applying tolls or user charges **Negative impact on** transport companies which need to deal with the administrative burden to purchase the Eurovignette; additional burden on public administration **Internalization of external costs** from road freight transport. The overall positive results affecting the society is a reduction of external (negative) effects, higher public income, support of climate change and the conservation of resources.																			
B 4.V	**Quantification of impacts**																				

B 5	ENVIRONMENTAL IMPACTS	AFFECTED SEGMENTS																Geographical level		Source	
		Passengers					Transport operators														
		Road	Rail	Air	Public transport	Slow modes	Road	Rail	IWW	Air	Maritime	Public transport	Employees in transport	Residents	Economy	Public bodies	Society	1st level	2nd level	Source of assessment	Spatial level of source
B 5.1	Air pollutants																↘	N	R	E	
B 5.2	Noise emissions																↘	N	R	E	
B 5.3	Visual quality of the landscape																				
B 5.4	Land use																				
B 5.5	Climate																↘	I		E	
B 5.6	Renewable or non-renewable resources																↘	I		E	
B 5.I	**Overall impacts on social groups**																				
B 5.II	**Implementation phase**																				
B 5.III	**Operation phase**																				
B 5.IV	**Summary / comments concerning the main impacts**	- Reduction of noise levels and pollution caused by road freight transport. Society as a whole benefits from lower noise levels and pollutant emissions; within the modes there is a likely shift from road to rail (also in terms of pollution); the additional negative environmental effects due to more IWW transport are negligible. To encourage fleet renewal, the Eurovignette provides for staggered exemptions that are limited in time for heavy vehicles with the cleanest engines (EURO 5, 6), including in sensitive areas such as mountain regions. - Improvement of infrastructure: the funds raised by the Eurovignette are used to finance the maintenance of the road infrastructure but also to cross-finance rail and IWW																			
B 5.V	**Quantification of impacts**	In the example of the Paris-Amsterdam corridor a decrease in congestion by 50%, of CO2 by 20%, of pollution by 30% and external costs by 14% were estimated [16].																			

C REFERENCES

C 1	**Other TPMs of this subcategory**	
C 2	**References**	**International** [1] Eur-lex: Directive 2006/38/EC amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures (17 May 2006) [FR] [DE] [2] OECD Observer: Road pricing: what's the deal? (March 2002) [3] European Conference of Ministers of Transport (ECMT): Tolls on Interurban Road Infrastructure. An Economic Evaluation (Report of the Round Table on Transport Economics 118, July 2002) [4] CEMR, Council of European Municipalities and Regions: Eurovignette directive : European Parliament and CEMR speak with one voice (Press release, 19 March 2004) [5] European Automobile Manufacturers Association (ACEA): ACEA position on Eurovignette Revision (30 September 2008) [6] European Automobile Manufacturers Association (ACEA): ACEA position on the internalisation of external costs (30 September 2008) [15] Gutiérrez Puebla, J. and Condeço-Melhorado (2011): A. Eurovignette impacts on market access: winners and losers, Universidad Complutense de Madrid. [16] Schroten, A. et al. (2011): External and infrastructure costs of freight transport Paris-Amsterdam corridor. CE Delft. [17] Gibson, G. et al. (2014): Evaluation of the implementation and effects of EU infrastructure charging policy since 1995. Ricardo-AEA and TRT. **National** [7] UK - Department for Transport: White Paper: A New Deal for Transport - Better for Everyone (July 1998) [8] Germany - Ministry of Transport: Lkw-Maut – Inkrafttreten des neuen Bundesfernstraßenmautgesetzes (BFStrMG) zum 19. Juli 2011; http://www.bmvbs.de/SharedDocs/DE/Artikel/UI/lkw-maut-inkrafttreten-neues-bundesfernstrassenmautgesetz.html (Juli 2011) [9] Germany - Ministry of Transport: Aktualisierung der Wegekostenrechnung f31-10-2011für die Bundesfernstraßen in Deutschland (2007) [10] Netherlands - Belastingdienst: Belasting zware motorrijtuigen (bzm); http://download.belastingdienst.nl/belastingdienst/docs/mededeling_bzm_ev0061z12pl.pdf (March 2010) [11] Joint industry position paper: Eurovignette III - Charging of Heavy Goods Vehicles Proposal (15 January 2009) **Regional / Local** [12] Institute for Transport Economics at the University of Cologne: External Costs in the Transport Sector - A Critical Review of the EC-Internalisation Policy (May 2008) [13] MORPACE International: Study on UK congestion charges and satellite-based road pricing (news release, October 2002) [14] Institute for Transport Studies, Leeds University (ITS): UK Surface Transport Costs and Charges (1998) [executive summary]