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FORESIGHT for TRANSPORT

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Foresight for Transport;
A Foresight Exercise to Help Forward Thinking in Transport and Sectoral Integration

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2 Executive Summary

The FORESIGHT for TRANSPORT project was launched in 2001 under the 'Competitive and Sustainable Growth Programme' (1998-2000) of the European Community with the main objective to organise and run a strategic dialogue in the form of a foresight exercise on the influence of non-transport factors and policy on mobility and transport.

The implementation of the project entailed the organisation of thematic expert panel consultations on the topics of enlargement, environment and energy, information and communication technologies, multilevel governance and time dynamics, a Delphi survey involving 165 experts around Europe as well as the establishment of a meta-database system with information on indicators that can be used to monitor developments in fields of relevance for transport and mobility.

The results of the project are documented in eight scientific deliverables.

- Deliverable 1 – the project's inception report – presents background information on the foresight method and the areas addressed by the thematic expert panel consultations.
- Deliverables 2 to 6 report on the results of the thematic expert panel consultations. Deliverable 2 deals with the subject of enlargement, Deliverable 3 with environment and energy, Deliverable 4 with information and communication technologies, Deliverable 5 with multilevel governance and Deliverable 6 with the time dimension. All consultation documents are available in English, French and German.
- Deliverable 7 is a report on the impact of external developments on mobility and the transport system. External developments are defined as all those factors that fall outside the direct realm of transport policy and the transport market. On the basis of the results of the thematic expert panel consultations these were classified as belonging to eight dimensions, namely, demographics, attitudes, social (policy) developments, institutional arrangements, science and technology, politics, the environment and the economy.
- Deliverable 8 is the project's monitoring system. The technical tool is accompanied by a manual as well as a feasibility plan on the further use of foresight in the transport field.

The *pathways* through which external and/or policy variables impact on transport and mobility – and both at the macro- and the micro-levels – was the focus of the FORESIGHT for TRANSPORT study. At the macro or aggregate level, the relevant associations were described through a reference scenario and a set of alternative scenarios. The reference scenario was specified with

the help of key measurable indicators and on the basis of projections based on expert judgement on how past and contemporary trends may unveil in the future. At the micro level, the impact pathway concept was used to describe the effects of very specific socio-economic, cultural and political trends on mobility and transport. Here the emphasis was placed on shedding light not only on the driving but also the intermediary role of developments operating outside the transport realm proper.

The scenarios for the future were elaborated in five thematic expert panel consultations and validated through a Delphi survey. The strategic dialogue also provided the material for the elaboration of the transport impact pathways. The latter were also submitted to validation through the Delphi survey. A second (smaller) round of expert consultations refined these impact pathways using the feedback of the Delphi survey.

In summarising the project's substantive findings we begin with the thematic areas which provided the starting point of the analysis, namely enlargement, environment and energy, information and communication technologies and multilevel governance.

The EU enlargement will impact on the volumes of traffic, the transport market and the organisation of the transport sector as well as infrastructure development. The impacts will however differ considerably depending on the institutional and socio-economic basis of the enlargement and alignment process. The strongest positive effects in terms of liberalisation, the harmonisation of prices and taxation as well as logistics, railway reform and TEN-T infrastructures can be expected under a scenario of rapid institutional and policy integration supported by high economic growth. Economic sluggishness and/or setbacks with regard to institutional reform following the variable geometry or core/periphery rationale would diminish these positive impacts or slow down their trajectory.

The environmental impacts of transport will be reduced only if sustainable environmental policies are adopted, also within the transport sector, and if people change their behavioural / lifestyle patterns. A significant reduction of both the speed and volume of transport (in absolute terms) would bring about revolutionary reductions of greenhouse gas emissions. These would be positive from the ecological point of view. However, such a 'strong sustainability' scenario risks having negative repercussions with regard to welfare. Alternative trajectories placing more emphasis on technological and logistics improvement within transport, the rational use of energy and renewable energy sources, more careful land-use planning as well as pricing and environmental taxation are, therefore, preferred. On their own, none of these measures could bring about sustainable changes, which is why it is important to work with policy-mixes at both the global and local levels. The possibilities of reducing the need for travel long distances for both individuals and goods through either the better spatial

location and organisation of services or the optimisation of agricultural (over-) production must also be examined.

Among technological developments, the development of the information and communication sector has over the past several years attracted most attention and high expectations are associated with the so-called information revolution, also for transport. ICT developments will affect the transport sector both in a direct and an indirect way. Direct impacts relate to safety and the efficient use of capacity through, for instance, the instalment of traffic management systems. Indirect effects relate to new modes of doing business (e-commerce) and new methods of work (teleworking) and are potentially more fundamental in the long-term. However the extent to which these technological changes will also result in measurable impacts within the foreseeable future largely depends on the pace of diffusion of relevant technologies, the legislative / regulatory framework within transport as well as commercial and labour market policy. The structure of economic activities and capital flows have also a significant role to play in this respect. Monopoly situations at the global level or protectionist policies at the national level might facilitate a more rational organisation and deployment of technology and lead to a better transport logistic organisation. However they are also associated with higher social costs and undermine market conditions. The major challenge faced in the technological field is thus how to optimise the diffusion of technological innovations in a market economy without undermining precisely those conditions that are necessary for technological innovation, namely, diversity, plurality, competition and collaboration.

Institutional arrangements covering the mode and structure of the policy process were found to be significant mediators of transport and mobility impacts. The multilevel governance context of supra-national political systems like the European Union necessitates networking and consultation at different levels, across sectoral boundaries and among several actors. In principle it is thus more conducive to open and participatory processes in decision-making and better policy outputs. However, it is also linked to higher transaction costs in terms of deliberation and coordination, longer delays with the implementation of policies and longer transition periods during which the distortions to competition may be accentuated.

Over and beyond the above, the assessment of how external developments impact on transport and mobility must also take into account developments in the labour market and how these affect wages and working hours; the evolution of leisure activities and tourism; and attitudes to the environment.

Demographic changes, household structures and residency patterns in relation to the place of work (and in this connection land-use and housing policy) are key contextual variables with regard to mobility. The structure and organisation of the transport sector, including logistics, as well as investment policy are important contextual variables with regard to freight transport.

Based on the above observations eighteen transport impact pathways were elaborated by the project and validated through the project's Delphi survey and second round of expert consultations. These impact pathways deal with the following subjects:

Regarding individual mobility and passenger transport

- The way ageing can be expected to affect transport demand as well as leisure patterns and the number of trips
- The way in which the valorisation of time, speed and flexibility among the population influences motorisation as well as tourist travel patterns
- The impact of attitudes to the environment on the use of the transport system
- The effect of the flexibilisation of the labour market, including the flexibility of working hours, on the type, length and frequency of local trips.
- The effects of the decentralisation of transport policy competences on urban and regional transport, including how conflicts on land use may affect network development.

Regarding (primarily) freight transport

- The impact of the emergence of a European level of decision-making with rising competences on network development and infrastructure investment as well as the role this has for a re-orientation of transport policy towards a new balance between modes and sustainable mobility.
- The role of technological innovation and diffusion – in general as well as more specifically with regard to alternative fuels and energy – on transport demand and on the environment (through transport).
- The way in which economic growth – in general and, in particular, in view of enlargement – can be expected to influence trade patterns and transport demand.
- The impact of restrictive migration policies on transport efficiency.

In the elaboration of the transport impact pathways we paid particular attention on specifying not only what drives developments but also what mediates development. External factors – including some not listed above – have in this respect often a much bigger role to play.

Individual mobility and, hence, short-distance passenger transport is especially receptive to external influences deriving from non-transport policy domains and relating to work, lifestyle, settlement and demographics. It is in these more 'distant' policy domains that we must look for what drives and mediates change whereby the 'distance' of these policy domains from the core (of transport and

mobility) also suggests that the changes thus effected are gradual and slow. It follows from this that, in order to be successful, mobility management within transport policy must elaborate strategies that are in line with contemporary forms of living and working and take into account demographic developments and settlement patterns. In addition, modern mobility management should try to effect changes within the above external policy domains that are consistent with sustainable mobility, for instance through the promotion of housing or labour market initiatives that take into account transport and environmental constraints.

Freight transport is a field which is more 'closed' in the sense of having clearer and more restricted boundaries of influence. The core triangle of economy, environment and technology is what drives developments. Change can also mostly be effected within this extended transport policy domain. A policy mix comprising investment, pricing (including environmental taxation) and technological measures (with regard to new sources and more sustainable uses of energy as well as the deployment of communication technologies for advanced traffic management systems) is here largely adequate for effecting change towards sustainable mobility. The main challenge is, however, how to operationalise such policy mixes at a broad scale. Insofar as long-distance freight transport is concerned, policies supporting the re-balancing of modes will only be effective if implemented at a broad level. This requires a re-thinking of decision-making processes towards better coordination and stakeholder involvement across countries and industrial sectors. The EU institutional framework provides a useful platform in this respect but is also comparatively novel. Not without reason the European or Common Transport Policy represents a master plan for the advancement and sustainable development of freight transport. Its success will however ultimately depend on the ability of the EU institutional framework to perform well as a multilevel governance structure.

How likely are we to meet the above challenges? A review of past and present trends and future projections based on expert judgement suggests a number of positive elements but also several problematic aspects in contemporary policies. The general expert view is that we can indeed observe a shift towards sustainable mobility. However given the slow pace of implementation of relevant policies (with regard to fuel prices, investment strategy etc.) and the likewise slow diffusion of innovations (for instance with regard to renewable energy) positive impacts in terms of environmental degradation or the re-balancing of modes is not expected to begin to happen prior to 2010. The White Paper projections on passenger and rail freight are contested by a number of experts: around half of the respondents agree with the statement that passenger rail and freight rail will be increasing at an average yearly rate of 2.7 per cent, the other half disagree. This is however also not surprising. The White Paper itself does not argue that such growth rates are possible at no cost or with no new policy initiative.

The future which represents the most desirable state of affairs is that which capitalises on the positive elements of the present and completely overcomes its negative aspects. This we have called the 'Sustainable European Ecological Identity' future scenario. Experts assess this as highly desirable but also as highly unlikely to materialise. This reflects pessimism in part but also pragmatism.

The negative future which we have called 'Governance Failure' focuses on the negative elements of the present and expects these to become worse in the years to come. This is caused by the prolongation of economic recession in conjunction with technological breakdown. The reason for calling this negative future state of affairs 'governance failure' has to do with the failure of existing institutional arrangements to deal with negative developments.

The present situation is not such that we can lie back and rest assured that inevitably it will all turn out well. The slow down of the economy in conjunction with increasing social inequalities and the real loss of power of social and political institutions to effect change in the short-term contribute to the perceived instability and insecurity. These dangers are not inherent to transport but they affect transport as well. Governance failure is not imminent but the tendency to substitute technocracy for governance is a real problem currently faced at both national and European levels.

Contextual conditions facilitating progress along the paths established by the transport impact pathways include a multilevel governance framework within which policy coordination and cooperation can be designed *and* implemented as well as a social policy agenda that assists in the integration of economic and social objectives in the face of the challenges of the knowledge society. A better linking of economic and social objectives will also make it easier to integrate environmental sustainability concerns into sectoral policy.

The above contextual conditions are largely independent from sectoral policy like transport. However transport policy would be advised to follow a similar logic when designing long-term strategy. This is also what is suggested by the analysis of the transport impact pathways identified by this study. To reiterate: individual mobility management must be better integrated with labour market and settlement policies and take into account both demographic trends and lifestyle patterns. Freight transport is a policy domain which can be easier delineated. A policy mix comprising investment, pricing and technology measures represents a suitable strategy towards sustainable mobility. This however presupposes that policies can be implemented on a broad scale and not only in select national environments. The challenge here is ultimately one of multilevel governance.

3 Objectives of the project

The FORESIGHT for TRANSPORT project had three strategic objectives:

1. To set up and run a strategic dialogue with the participation of experts from different disciplines as well as representatives of business and industry, policy-makers and interest organisations that identifies the critical *external* factors that influence mobility and transport policy and specifies the contextual scenario conditions within which these developments take place.

2. To use the input from the strategic dialogue to specify the impact of external developments and associated trends on mobility and the transport system and elaborate the concept of the transport impact pathway.

3. To develop a procedure for monitoring external developments and their impact on transport in the future.

The following four policy areas delineate the original scope of the project: EU enlargement, Energy and Environment, Information and Communication Technologies (ICT) and Decision-Making in a Multi-Level Governance Context.

The research work was organised through a set of three RTD-specific work packages, each corresponding to the project's three objectives.

WP1 [A Strategic Dialogue on Transport]. The objective of this work package was to set up and run expert panels for each of the four original themes under examination. A fifth expert panel focused on the time dimension and its relevance for transport and non-transport policies. The organisation of the expert panels included the selection of experts for each panel, the organisation of consultation meetings, the writing up of consultation documents and their submission to a wider expert debate through a Delphi survey.

WP2 [A Strategic assessment of impact of non-transport policies on mobility and transport] elaborated a framework based on the concept of the impact pathway linking external variables to transport impact variables at the macro- and micro-levels. At the macro or aggregate level, the relevant associations were described through a reference scenario and set of alternative scenarios. These were in turn described with the help of key measurable indicators and projections based on expert judgement on how past and contemporary trends may unveil in the future. At the micro level, the impact pathway concept was used to describe the effects of very specific socio-economic, cultural and political trends on mobility and transport. Here the emphasis was placed on shedding light not only on the driving but also the intermediary role of developments operating outside the transport realm proper.

WP3 [A Monitoring Procedure] developed a monitoring system in the form of a meta database with information on key indicators in non-transport related fields. This monitoring system provides a basis for the continuation of the strategic dialogue in the form of foresight in strategic transport policy assessment.

The FORESIGHT for TRANSPORT study was implemented in the years 2002 and 2003. This is the project's final report compiled in early 2004. Chapter 4 is devoted to describing the project's scientific results and forms the bulk of this document. Chapters 5 to 7 deal with technical issues relating to the coordination and management of the project. Chapter 8 draws conclusions from the research for policy and in terms of methodology. This report as well as all other of the project's deliverables can be downloaded from the project's Web Site at http://www.iccr-international.org/foresight

4 Scientific and technical description of the results

4.1 Conceptual framework

Figure 1 specifies how models formally conceptualize the operation of the transport system subject to external and policy influences and its effects. *Outcome variables* measure the performance of the transport system internally as well as externally, for instance on the environment, the economy or employment. The *system models* represent the parts of the transport system, such as transport costs or network characteristics, the performance of which determines the values of the *outcome variables*. Two sets of forces act on the system and can lead to changes in the structure of the system and its elements: *external forces driving structural change* (FDSCs) and *policy changes*. The external forces are highly uncertain. *Scenarios* are the analytical tools that are used to represent and deal with these uncertainties. Policy changes are described in terms of the values of *policy variables*.

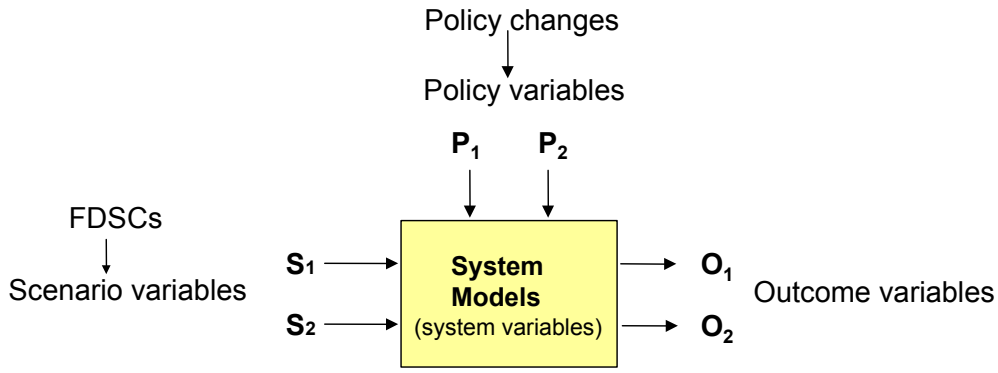

Figure 1
Generic overview of how to formalise impacts on transport system in transport modelling
Source: Walker 2001 and THINK-UP Deliverable 10, 2002

System models are designed to use the values of the scenario and policy variables as inputs. When the system models are run, the changes that the external scenarios and the policies produce in the structure of the system produce changes in the outcome variables.

As stated, this is the basic theory behind the operation of transport models. This basic theory rests however on several premises that should be adequately understood and at the same time scrutinised in order to appreciate what

transport models can and cannot do but also for correctly interpreting the projections or analyses they deliver. These premises are as follows:

As the visual representation in Figure 1 suggests, the basic transport model theory assumes that it is useful and possible to categorize the different variables under different dimensions and that this is possible both on substantive and temporal grounds. External variables are different from outcome variables and precede these in representing the causes of changes that produce effects that, in turn, can be measured through outcome variables.

The analytical advantage of such an approach is obvious. The problem is however that variables cannot always exhaustively be classified as belonging to only one category. Transport costs, for instance, is both a variable that drives the transport system (hence impacts on economic efficiency) and an impact variable of transport or other policies such as the increase of fuel duties.

Drawing clear temporal boundaries between the input and output sides goes some way to resolving the above problem but it does not entirely do away with it. It is equally important to formalise within the 'black box' referred to as 'transport system' in the figure above the assumptions which underlie the mathematic algorithms that transform changes in either the external or policy system into changes in the transport system and, in turn, into changes in outcome.

The majority of existing transport models operate with rather straightforward, albeit simple, assumptions. Thus all or most external and policy changes are 'transformed' into changes of either travel time and/or transport costs and these variables are subsequently used to estimate outcomes. The spatial assignment of the latter is done with reference to the characteristics of the infrastructure network and background characteristics like population density or past trends. Feedback loops to account for dynamic changes over time as well as the way in which outcomes produced by policy or external developments feed back on these policies or external developments are beyond the scope of strategic transport models in the current state-of-the-art.

There is nothing in principle wrong with basing complex computations on simple assumptions. Simple assumptions are good not least for being easy to understand and communicate. If they are right they lead to correct projections and if they are wrong the projections will be wrong and then the assumptions would have been falsified. We can leave for the moment aside the possibility that the projections might turn out right despite wrong assumptions or wrong despite correct assumptions.

A more serious problem has to do with the so-called ecological fallacy. The ecological fallacy is committed when we deduce from relationships or associations we observe on the aggregate level among certain variables

equivalent degrees of associations at the micro-level. The correlation between a high quality infrastructure network and the degree of congestion does not necessarily imply, for instance, that investment into infrastructure will lead to a reduction of congestion. That this occurs will equally depend on the timing of the investment, the mode of infrastructure and its location as well as the availability of alternatives. Many an investment done in the hope of reducing congestion in particular areas has had not more than a very short-term effect in terms of congestion per se. (Of course this does not negate the economic and social benefits of infrastructure investment). Policy which is based alone on projections deriving from transport models which operate with associations observed on the aggregate level are therefore likely to imply bad policy.

Starting from this realisation, the FORESIGHT for TRANSPORT study has had as main objective to clarify the *pathways* through which external and/or policy variables impact on transport and mobility.

Our research has been motivated by two key considerations: first, to provide a framework for thinking through policy interventions while at the same time paying attention to the interrelationships between relevant factors; and second, to establish an analytical basis which is complementary to transport modelling and which, hopefully, is also used to advanced the theory and practice of the latter.

A more analytical presentation of impacts deriving from external features on transport and mobility with an emphasis on what these external dimensions might be is visualised in Figure 2.

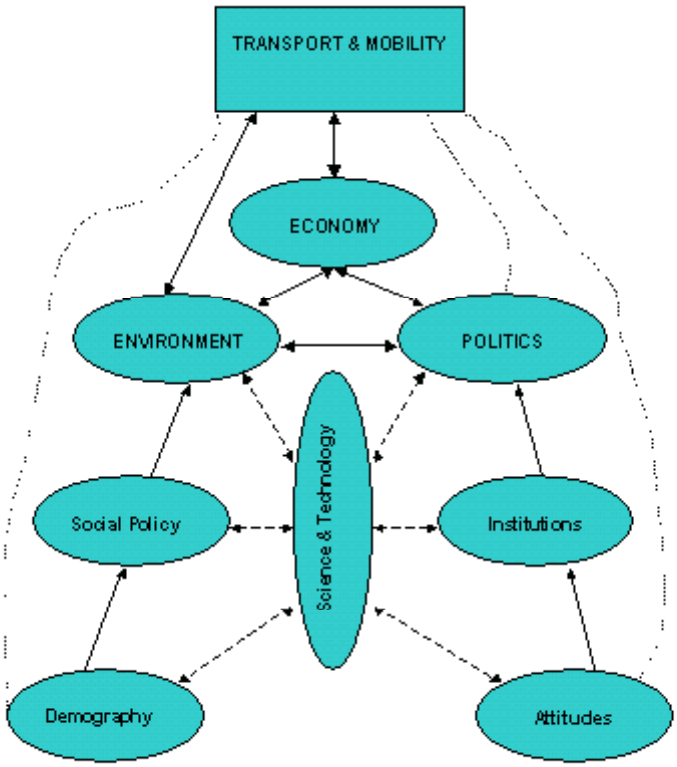

Figure 2
External features influencing mobility and transport and possible links

The classificatory scheme of external dimensions was identified in the course of the first round of the expert panel consultations organised by the project (see below).

Figure 2 entails a number of assumptions:

1. The more distant external elements are to be found from the top box representing mobility and transport, the weaker their *direct* impact will be. This does not mean that such elements may not have a direct impact on mobility. However, it is more likely that their impact is mediated through other external factors.

   An example of this is the way in which demography impacts on mobility. Population growth is a variable used in strategic transport models for drawing estimates of transport demand. Population density is used to assign traffic flows and to value the impact of environmental degradation that results from transport.

Mobility management can however not alone rely on estimations about possible transport demand. The problem of mobility management is not one of quantity. (If this were the case, then there would in fact be no contemporary problem in terms of mobility management given that the population in EU countries has been stagnating over years). More significant is the mobility of different population segments and how this relates to work and leisure.

2. Science and technology is centrally and vertically located in the above diagram to represent how this is influenced but also influences other external factors and, hence, mobility and transport. Studies on the impact of technology show that innovations are alone not enough to effect a significant change of strategic and implementation procedures in policies but that the diffusion of innovations is equally, if not more, important. The diffusion of innovation is itself dependent on the more general socio-economic, attitudinal, political and institutional context.

   The emergence of new information and communication technologies was greeted as a step that would revolutionalise the way we live and work and would, as a result, reduce the need to travel. Insofar as people – it was claimed – would increasingly work from home, this would change their daily travel patterns and reduce the need for commuting and hence also congestion around peak hours. The new information technology would also change the way of doing business: e-commerce would not only bring about significant efficiency gains by speeding the transaction processes; it would also contribute to decreasing the absolute number of trips in that it would allow a better logistic organisation of transport.

   Almost two decades after the onset of the so-called 'information revolution' it is becoming clearer that information technologies are not different than other technologies. Their impact is dependent on their diffusion and the latter is determined by other factors.

3. The location of the triangle politics-environment-economy close to the top is indicative of the significant role of business and industry, on the one hand, as well as politics, on the other, in filtering developments from other 'lower' factors and in having an own sustainable impact on transport and mobility. The addition of environment to this core reflects the realisation within both the economic domain and the political field that the environment is a key factor for determining the societal sustainability of the future.

   Transport demand is coupled to economic growth. This is a relationship which has asserted itself over a long historical period and which persists despite the gradual decoupling of economic growth from labour market demand, on the one hand, and material throughput on the other. Given the comparatively large contribution of transport to environmental degradation,

there are increased calls for a re-thinking of transport organisation and management towards 'sustainable mobility'. Sustainable mobility represents the re-balancing of socio-economic and environmental needs in the transport domain.[1] It is left to politics to act as broker between these needs and conceptualise related strategies.

4. Continuous lines or arrows indicate stronger impact pathways than broken lines or arrows.

   The positioning of the external dimensions as well as the strength of the relations between them can change depending on what future is envisioned. The constellation presented in Figure 2 is a generic one that corresponds closest to the 'business-as-usual' scenario. It is however possible to envisage alternative futures where specific impact pathways are either irrelevant or very weak insofar as mobility and the transport sector are concerned.

4.2 Methodological approach

4.2.1 General

The elaboration of impact pathways that link external elements to mobility and the transport system can be operationalised in four steps:

- First, it is important to gather an expert knowledge base on each of the external dimensions. This involves understanding what drives developments for each, what are the main contextual issues involved and how these are likely to play out in the future.

- Second, it is necessary to define measurable indicators for each dimension, collect what data might be available, describe actual trends and estimate how these might develop in the future. This establishes a basis for the reference scenario, i.e. that scenario which best describes the present and the latter's trajectory into the future.

- Third, it is possible to think of alternative ways in which the various dimensions correlate with each other and with transport and mobility. Such alternative global futures provide the setting for specific impact pathways.

- The fourth step is that of specifying the impact pathways at the micro-level as well as the degree of association between factors that are linked along this pathway.

The FORESIGHT for TRANSPORT project as the name suggests has relied on the foresight methodology to accomplish the above steps.

The time frame for the FORESIGHT for TRANSPORT exercise was the time from now till after 2020, distinguishing between the short-term (2004-2009), medium-term (2010-2019) and long-term (2020+). Geographically the exercise focused on the extended European Union.

In what follows we present the foresight methodology and describe how this was used in the present study. In the final part of the methodological section we discuss the advantages and disadvantages of the foresight methodology as compared to other methods of policy assessment and forecasting.

4.2.2 The foresight methodology

Foresight is "a systematic, participatory, future-intelligence-gathering and medium-to-long-term vision building process" (FOREN, 2001) used to anticipate socio-economic, political, institutional, environmental and S&T changes and, accordingly, define suitable policy strategies.

Foresight exercises have been used for the following purposes:

- To forecast developments and changes in the areas of society, environment, economy, technology and science, and create policy strategies to meet the challenges.
- To define key areas of science and technology that are vital for economic development and hence should be prioritised for funding.
- To elaborate pathways of technology application to create wealth and improve the quality of life whilst respecting environmental concerns.
- To identify market opportunities for specific business or industrial sectors.
- To set up collaborative programmes between industrial companies and government.
- To create enduring networks linking different interest groups such as scientists, policy makers, industrial companies, funding agencies and various specific stakeholders.

Whether aiming at elaborating policy or business strategies about the future or determining priorities for science and technology, foresight exercises (and definitions) share the following two criteria:

- Foresight is always concerned with the long-term look into the future, typically with a time frame of five to thirty years.

- Foresight is a process rather than a set of techniques, which contains the interaction of many societal groups like the scientific community, policy makers, government, different sectors of the economy and other users. Increasingly foresight is also used as a broader participatory and networking technique, especially at the regional level.

Thematically, typical areas of application of foresight have been science & technology, education and research, business, critical technologies or products (with reference to ICT or biotechnology, for instance), demographics, employment as well as crime. Foresight exercises on environment, transport, enlargement or governance are less prevalent, however such themes are increasingly attracting attention from foresight practitioners.

Foresight can be found at the interface of 'policy analysis', 'strategic planning' and 'future studies' (FOREN and EC, 2001), and through its particular relevance for the S&T field also innovation studies (de Laat, 2000). Not surprisingly, it is a broad and rather protean field where terminology – generic or methodological – is not always clear or consistent. Thus de Laat notes:

> "Futures methods are difficult to categorise and, in studying the literature, it turns out that different authors classify similar methods differently. In fact only the meaning of 'forecasting' is relatively well shared (…) most agreeing that it relates to the quantified prediction of future events, arrived at through formal modelling and/or expert opinion. But even then the boundaries differ (…). As an alternative, others propose distinctions between forecasting and the actual planning process, between prevision/forecasting and prospective/foresight, or again between strategic analysis and foresight …" (op. cit. pp.178-9).

Recapitulating, it could be said, that foresight is an overall attempt to prepare for future challenges and changes by trying to assess the challenges entailed in the long-term future. Generated strategies should not only prepare for future challenges but also try to influence and alter the changing process due to own perceptions and goals.

There are several techniques that can be used in foresight. Central to a foresight exercise are expert consultations, which, in turn, can use brainstorming and scenario-writing analysis. The Delphi survey method is also often used in foresight in order to first, draw more experts in the consultation process and second, for reaching convergence of opinion or identifying convergence patterns. Quantitative methods like trend extrapolation or simulation modelling are used when trend data is available.

The FORESIGHT for TRANSPORT study has used a number of the possible foresight techniques. These are described below.

4.2.3 Expert consultations

The FORESIGHT for TRANSPORT project organised two rounds of expert consultations.

The first round took place during the project's first year (June 2002), lasted a full week and was used to gather knowledge relating to external dimensions. These expert consultations were organised around five themes – environment, governance, communication technologies, enlargement and time politics – and involved around fifty experts.[2] The results are summarised in five consultation documents (Deliverables D2 to D6).

The second round of expert consultations took place towards the project's end in October 2003 and lasted three days. This was a much smaller consultation exercise involving twelve experts.[3] The objective of this consultation was to receive feedback to the project's findings on the transport impact pathways and the monitoring system (Deliverables 7 & 8).

The reliance on external expertise as well as the requirement to cover as many alternative views as possible means that a key element of a foresight exercise and perhaps of its success lies in the adequate and representative selection of experts and stakeholders to participate in the workshops and/or Delphi survey (see below). Much of the effort that has gone into the present study has dealt with trying to achieve a reasonable balance between broad coverage, on the one hand, and detailed knowledge, on the other. Experts were selected on the basis of their work in the areas under investigation as documented in academic and other publications, membership in key policy communities (as decision-makers, advisers or members of lobbying organisations) and/or experience with working with business and industry. The structural constraints entailed in the organisation of a foresight exercise (with regard especially to time availability for participating in workshops) has meant that our sample was least representative of persons working directly in business or industry as well as officials working for European institutions. The indirect involvement of many of the other participants in these sectors, however, has in part controlled for this problem. In any case, this is an issue that needs special attention when planning and implementing foresight exercises.

4.2.4 Brainstorming

The expert consultations, and especially the first round, used the brainstorming and scenario-writing techniques to guide the deliberations.

Brainstorming is a group / seminar technique used at the onset of consultations to generate ideas and support creativity. It involves first, a period of free thinking

for generating and listing ideas and subsequently an analytical phase for organising, clustering and prioritising these.

The thematic expert consultations organised by the FORESIGHT for TRANSPORT project were structured around the following question used to elicit ideas:

> *What are the important drivers and/or key issues with regard to [enlargement; energy and environment; ICT; governance; time dynamics …]?*

Subsequently, and in order to help cluster the various drivers and issues, participants were asked to think in terms of their temporality, their geographical scope and their relevance for transport (direct or indirect).

This generated the classification of drivers and issues in the eight-fold scheme comprising demographic factors, attitudes, social policy related developments, institutional arrangements, science and technology, environment, economy and politics. It furthermore provided much of the knowledge base[4] for the specification of the transport impact pathways at the micro-level (see section 4.3.3).

4.2.5 Scenario-writing

Scenarios represent visions / images of the future and courses of development organised in a systematic and consistent way.

There are different types of scenarios depending on the objectives and perspective of the scenario writer(s) and their use. In summarising the relevant literature Ling (2000) draws a useful distinction between the 'precautionary model', the 'visionary model' and the 'learning model' of scenario writing.

Scenarios developed under the 'precautionary model' approach have as a goal to envisage a negative future state resulting from a certain course of events in order to demonstrate or make explicit the negative consequences of present actions and elaborate ways to counteract these. Under the 'visionary model', a preferred future is outlined and then strategies for reaching this future are outlined using the so-called back-casting approach (cf. Banister and Stead, 2001). Both the 'precautionary' and 'visionary' models of scenario writing are normative in orientation. In consultation and/or assessment exercises further insights can be gained by comparing different normative scenarios arrived at by different stakeholders or institutions.

Scenarios developed under the 'learning model' follow the extrapolative approach whereby between two and four desirable and/or plausible futures are described based on a systematic analysis of current trends:

> "In the first instance [this] involves scenario building through which participants may come to understand the complex interconnections in their policy arena. Then the process involves using these scenarios either to test existing strategies (…) or to create new policy options" (Ling, op. cit., p.263).

The FORESIGHT for TRANSPORT project relied primarily on the 'learning model' approach of scenario-writing. Participants were provided with a summary of the issues produced through brainstorming in their respective sessions and asked to select those that would in their opinion be most suitable for describing (a) the present situation and (b) possible futures. Thereafter they had to individually and/or in groups elaborate textual descriptions of the baseline scenario and possible alternative futures. Through deliberation each group came eventually to agree on the baseline scenario and a limited set of alternative futures.

The core research team of the FORESIGHT for TRANSPORT project used then the various scenarios elaborated by the thematic expert consultation panels to specify a generic baseline scenario and seven alternative future scenarios.

Our experiences with scenario-writing showed that in practice it is not possible to a priori exclude specific types of scenarios. Thus the scenarios developed by the experts participating in the FORESIGHT for TRANSPORT consultation meetings and further elaborated by the core research team include also normative or visionary elements and negative scenarios. The latter can be used as benchmarks or orientation points against which to assess the larger range of plausible scenarios (see section 4.3.6).

4.2.6 Delphi survey

A Delphi survey involves the survey of expert opinion – consecutively over a number of waves and a period of time – for identifying developments and/or trends and reaching gradually a convergence of opinion without physically coming together. The latter is often presented as one major advantage of the Delphi method over other physically-bound consultation procedures for two reasons: first, because it allows the participation of a wider circle of experts in the consultation exercise and second, because it thus controls for the disproportionate influence of any single participant.

The main disadvantage is that Delphi surveys can be very expensive and time-consuming and that even if successful in obtaining a high response rate to the

first wave of the questionnaire, it is problematic to keep a high longitudinal response rate over several questionnaire iterations.

The FORESIGHT for TRANSPORT project used a two-wave Delphi survey over a period of nine months, January to September 2003. The first-wave questionnaire was distributed among 455 experts around Europe with a specialisation in either transport and/or another field of relevance for transport and mobility.

The first wave of the FORESIGHT for TRANSPORT Delphi survey sought to validate the results of the first round of the expert consultations on critical non-transport factors and scenarios. Respondents were asked to rate critical factors with regard to their relevance; scenarios were assessed with regard to likelihood and desirability.

The second wave of the FORESIGHT for TRANSPORT questionnaire fed back to respondents the results of the first wave of the survey and asked them to reflect upon or confirm their original choices. Against this background, several transport impact pathways were submitted for commenting and validation. The second part of the questionnaire presented respondents with a series of quantifiable transport-relevant trends and asked for assessments with regard to the continuation (or reversal) of these trends in the short-term (2004-2010), medium-term (2011-2019) and long-term (2020+).

The average time for completing the first wave questionnaire was estimated at between 45 and 60 minutes, that of completing the second wave questionnaire at between 90 and 120 minutes.

The response rate for the first wave of the survey amounted to 36 per cent bringing the number of responses to 164. The longitudinal response rate was 65 per cent: 94 respondents reacted to the second wave of the questionnaire. Given the length of the questionnaire, respondents to the second wave of the survey were given the option to reply to only parts of the questionnaire. Most parts of the second-wave questionnaire were answered by between 52 and 85 respondents.[5]

4.2.7 Quantitative methods: trend extrapolations of key indicators

Foresight may also make use of quantitative methods like trend extrapolation or simulation modelling.

In FORESIGHT for TRANSPORT trend extrapolation was used for indicators selected as important for monitoring future developments with regard to either transport or external developments. These indicators are described in detail in the project's monitoring system (Deliverable 8; see also section 4.3.2). The

trend extrapolations were used in conjunction with the feedback provided by the Delphi survey to detail the reference scenario (see sections 4.3.4 and 4.3.5).

4.2.8 What is the foresight methodology good for?

Foresight is one methodology among many in the field of (technology) futures analysis (TFA). The TFA Methods Working Group has come up with a compilation of the methods that are used in TFA with reference to the work carried out in the framework of the Millennium Project of the United Nations University (Gordon and Glenn, 2003 cited in Technology Futures Analysis Methods Working Group 2004). Their list includes over 50 methods, including the methods reviewed in sections 4.2.3 to 4.2.7. In turn, these can be classified into nine 'families' depending on their conceptual framework and general objectives: besides so-called 'creativity' methods that include brainstorming and workshops, there are descriptive methods, statistical methods, methods relying on expert opinion, monitoring methods, modelling, scenarios, trend analyses and valuing or economic methods. The various methods can furthermore be analysed with reference to the type of data they rely on ('hard' vs. 'soft') and the extent to which they are normative or exploratory. The members of the TFA Working Group point out that the separate 'maturing' of many of these methods ("with little interchange and sharing of information") has resulted in a lack of clarity regarding the usefulness and applicability of the methods as a whole and individually.[6]

Anticipating similar concerns by the readers of this report and before proceeding to present the study's main results it might here be useful to discuss the usefulness of the foresight methodology.

In presenting our study's conceptual framework in section 4.1 we discussed how the approach followed in FORESIGHT for TRANSPORT differs from that adopted by strategic modelling exercises that deliver forecasts regarding transport developments and, on this basis, an assessment of impacts. To reiterate, our study instead focuses on unveiling *how* changes within the external or policy environments come to impact on transport and mobility. The key term here is 'how', hence also the organisation of our research around the notion of 'impact pathway'. In other words, while models work with already established assumptions about cause and effect in order to achieve an estimation and valuation of impacts, our study has sought to clarify the cause-effect relationships as *processes* – in time and through a range of intermediate variables or policy domains.

It is this emphasis on the process rather than the quantifiable outcome that has led us to choose foresight as a methodology for the present study. Understanding process in conceptual terms, i.e. the impact pathways, implies

integrating specialised knowledge as well as different normative appreciations regarding the future. The participatory approach that is used in foresight through expert consultations, brainstorming and scenario-writing allows the gathering and analysis of such information as well as its validation through reflection. At the same time foresight has the advantage of raising awareness among participants regarding transport policy and how it is related to other policy domains. In this connection the title of the project 'A foresight exercise to promote forward thinking in transport and cross-sectoral integration' should be borne in mind. The FORESIGHT for TRANSPORT study was set up to also demonstrate the applicability of the foresight methodology for organising a strategic dialogue on transport and mobility.

Thinking about the future does not only mean thinking about developments which are uncertain. It also means thinking about issues which are contested at this particular point in time. Foresight is a methodology that allows the reporting and organisation of contested views in such a way as to allow their further analysis towards the identification of compromise solutions, which is what policy is ultimately about in democratic societies.

To summarise: the foresight methodology is a good methodology when concentrating on issues which are process-oriented either substantively in terms of scope and content and/or with regard to the actors involved. Understanding how transport and mobility develops in the future and how these developments relate to developments in other policy domains is one such area. The knowledge thus gathered is of use for scrutinising and thereafter refining policy implementation strategies – especially at the micro-level – as well as for elaborating long-term strategies in a strategic manner, i.e. in relation to other policies. Furthermore the information gathered can be used to improve the assumptions underlying strategic models thus contributing to the amelioration of the latter's projections and their better interpretation.

What a foresight exercise cannot deliver – and what it should not be expected to deliver – is quantifiable and objective evidence-like statements or projections about short-term developments or impacts. It is in fact questionable whether there are any scientific methods that can deliver such straightforward and certain answers. Consider, for example, the question whether railway investment can be expected to lead to a modal shift from road to rail. We can probably answer this question with 'yes' but this alone is of little use in terms of defining a policy and implementation strategy. The more significant question is 'by how much' and 'will it be enough' [to effect a sustainable re-balancing of modes]. It is here that the answers begin to be more complicated and ultimately frustrating from the point of view of the policy-maker. Even if we were to assume that the quantifiable effect of railway investment on the modal split will be proportional to the amount of railway investment, there are several other factors that need to be taken into account for the estimation. These include at least the pricing regimes in place at present and at the time of completion of the

infrastructure construction as well as the level of development of the road network, including road-relevant technologies. In other words, there can be no single objective answer to this question, even if we were to assume that the policy question under investigation involves only a few parameters. At best one can provide an answer in terms of a 'range of values' that can in turn be used to better specify the degree of investment and the time framework of its implementation.

Keeping with the same hypothetical question the following can be said about the comparative advantage of foresight exercises as compared to policy assessments driven by modelling. Whereas models that work with a certain limited set of parameters can supply these ranges of outcome values, foresight exercises can provide an insight into how the underlying processes work out in practice and, significantly, how these are influenced by other contextual conditions. The latter are especially of importance in situations where, say, the capital investment resources necessary for effecting a significant modal shift are simply not available. In such a situation the significant other factors, like, for instance, the logistic organisation of existing railway services or urban planning, might gain in significance in being more amenable to change at a lower cost or at a cost which can be easier distributed among public and private actors. [7]

The problem of modern policy-making as well as science for policy is less that developments at the macro- or aggregate level have become more complex but more that the degree of conditionality at the micro-level has decreased together with the increase of autonomy of individual actors. This means that social institutions are less powerful in effecting change through simple and straightforward policy responses (Stehr 2003).[8] Substantive and long-lasting transformation can thus only come about through the accumulation of several smaller-scale and often disparate – at first sight – actions operating at the interface of policy domains rather that within any single perspective. Foresight exercises, unlike mainstream transport modelling, can help identify such interfaces. Furthermore, in following the network logic they help bring relevant actors together, thus assisting in the drawing of interconnections at the level of action.

4.3 Main results

4.3.1 External non-transport factors influencing transport and mobility

External non-transport factors that may have a direct or indirect impact on mobility and transport may be classified as belonging to one of the following eight dimensions (see also Figure 2):

- Demographics
- Attitudes
- Social developments
- Institutional arrangements
- Science and technology
- Politics
- Environment
- Economy

4.3.1.1 Demographics

Contemporary demographic developments within the enlarged Europe are dominated by decreasing or stagnating populations due to an increase of life expectancy in conjunction with low or declining fertility rates. According to the Eurostat population report for the year 2003 (Eurostat 2003), in most EU Member States the population growth (at a relatively low level of less than 3 per cent per year) is currently only possible through net migration. Migration is, however, restricted in most countries and this is not expected to change in the future, at least not within the EU-15 in view of eastern enlargement.[9] In the new Member States we can observe a negative population growth with few exceptions (Cyprus and Malta).

The stagnating or declining populations in European countries have fuelled the so-called active ageing debate. In view of the crisis of the pension and health systems, this debate is primarily concerned with increasing the productive age of the working population through regulatory measures (increase of retirement age or gradual abolishment of early retirement schemes) or other incentives.

Population growth is a key variable used in strategic transport models for making estimations on transport demand. In view of the pattern of contemporary demographic developments – and, in particular, the ageing of society – it is important to consider additionally the development with regard to specific population segments. Of particular relevance in this respect are: (a) the segment of persons aged 60 + (55+ among women) and still active in the labour market; (b) the segment of retired persons (currently as of 55+, later as of 65+). The former segment is relevant for understanding mobility needs related to work, the latter is key in terms of medium- and long-distance leisure travel.

4.3.1.2 Attitudes

Attitudes mediate impacts on transport and mobility in several ways. Attitudes to time and speed influence directly the attitude to individual travel and the choice of mode. Reliability is an important element for enterprises with regard to freight transport and the latter's logistic organisation.

Equally important are indirect attitudinal influences. Environmental attitudes are considered a key to success for environmental policies be it with regard to choice of mode, lifestyle choices concerning housing and settlement, consumer patterns regarding cars, or in terms of the willingness to pay for user-induced pollution through motorisation – directly or through environmental taxation.

Another important set of attitudes concern those to new technologies. At the level of enterprises, a positive attitude to technology implies a higher and faster rate of diffusion of innovations such as e-business and teleworking or with regard to new engines, the diversification of energy sources, or the rational use of energy.

4.3.1.3 Social developments

In contemporary societies we can observe a trend towards the flexibilisation of labour. This is evidenced by the increase of part-time work as well as telework, the introduction of flexible working times in several economic sectors but also the increase of unemployment and the reduction of job stability. Life-long and full employment are no longer considered realistic goals among political elites and the social policy community.[10] At the same time there is a steady increase of the employment moratorium period in young age due to longer education and training periods in conjunction with stagnating labour market demand.

The labour market situation and especially the flexibilisation of labour will affect mobility patterns by challenging the nine-to-five work and delivery day and the peak congestion hours associated with this. Even though this could alleviate the strain on transport networks in periods of economic stagnation, in periods of economic growth it could also lead to a deterioration of the situation. The flexibilisation of the labour market must be monitored in conjunction with ageing trends and household arrangements given the interrelation of the three factors regarding mobility.

Another social factor of potential relevance for transport policy has to do with the distribution of economic resources and the level of inequality. Household income correlates strongly with GDP per capita and could be thought of as a proxy to the latter for the estimation of transport demand. The average values of household income or GDP per capita, however, say little about how the latter is distributed within the population. As economic measures increase in importance in the transport policy domain and given the gradual deregulation of public transport services, the assessment of levels of inequality is likely to gain in significance for transport politics.

4.3.1.4 Institutional arrangements

The re-arrangement of state functions that has come about through the process of European integration produces regulatory overload, making decision rules and reforms necessary – for instance, with regard to subsidiarity, the sharing of competencies / responsibilities between the supra-national, national, regional and local levels of government (multi-level governance), and the balance of power between Community institutions – in particular the European Commission, the European Parliament and the Council.

The multilevel governance context of supra-national political systems like the European Union necessitates networking and consultation at different levels, across sectoral boundaries and among several actors. In principle it is thus more conducive to open and participatory processes in decision-making and better policy outputs. However, it is also linked to higher transaction costs in terms of deliberation and coordination, longer delays with the implementation of policies and longer transition periods during which the distortions to competition may be accentuated. Two recent examples of the opportunities and problems entailed in complex institutional arrangements are the initiative concerning road pricing and the proposal to increase the share of EU financing of TEN-T projects.

4.3.1.5 Science and technology

The development of the information and communication sector has raised high expectations in terms of the efficiency and effectiveness of doing business. ICT developments will affect the transport sector both in a direct and an indirect way. Direct impacts relate to safety and the efficient use of capacity through, for instance, the instalment of traffic management systems. Indirect effects relate to new modes of doing business (e-commerce) and new methods of work (teleworking) and are potentially more fundamental in the long-term. However the extent to which these technological changes will also result in measurable impacts within the foreseeable future largely depends on the pace of diffusion of relevant technologies, the legislative / regulatory framework within transport as well as commercial and labour market policy.

The structure of economic activities and capital flows have also a significant role to play in this respect. Monopoly situations at the global level or protectionist policies at the national level might facilitate a more rational organisation and deployment of technology thus leading to a better transport logistic organisation. However they are also associated with higher social costs and undermine market conditions. The major challenge faced in the technological field is thus how to optimise the diffusion of technological innovations in a market economy

without undermining precisely those conditions that are necessary for technological innovation, namely, diversity, plurality and competition.

4.3.1.6 Politics

In policy assessment politics is often considered the black box of decision processes driven more by short-term electoral motivations than long-term and serious policy commitments. Nevertheless political ideologies as well as political culture are less 'irrational' than what they appear at first sight. The same is true of the political process as such. Strong political parties and a strong parliament are indicative of strong interest representations which also mediate conflicts. Political cultures with weak parties tend instead to technocracy and/or the prevalence of issue-based politics and often to intractable policy conflicts. Contemporary European political culture is of the latter type. Institutional reforms and the crystallization of the EU political system will influence the political process for resolving transport policy conflicts. It is for this reason that political developments correlate strongly with attitudinal trends and institutional changes.

4.3.1.7 Environment

The environmental impacts of transport will be reduced only if sustainable environmental policies are adopted, also within the transport sector, and people change their behavioural / lifestyle patterns. A significant reduction of both the speed and volume of transport (in absolute terms) would bring about revolutionary reductions of greenhouse gas emissions which would be positive from the ecological point of view. However, such a 'strong sustainability' scenario risks having negative repercussions with regard to welfare. Alternative trajectories placing more emphasis on technological and logistics improvement within transport, a more rational use of energy and renewable energy sources, more careful land-use planning as well as pricing and environmental taxation are therefore preferred. On their own, none of these measures could bring about sustainable changes, which is why it is important to work with policy-mixes at both the global and local levels. The possibilities of reducing the need to travel long distances for both individuals and goods through either the better spatial location and organisation of services or the optimisation of agricultural (over-)production must also be examined.

4.3.1.8 Economy

The impact of economy on transport demand is a well-known phenomenon. GDP growth and trade relations are the key variables for predicting transport

volume and assigning transport flows. Mainstream scenario building for the description of external developments and how these influence transport are typically driven by GDP growth. Estimations regarding transport costs or motorisation rates are likewise often made with reference to GDP growth rates.

The FORESIGHT for TRANSPORT project did not focus on economy and its role for transport as this has already been studied in depth elsewhere. Instead we looked at the expected impacts of enlargement on transport. Enlargement is considered the main motor of economic developments in the future and as such it is expected to also significantly influence transport flows.

The EU enlargement will impact on the volumes of traffic, the transport market and the organisation of the transport sector as well as infrastructure development. The impacts will however differ considerably depending on the institutional and socio-economic basis of the enlargement and alignment process. The strongest positive effects in terms of liberalisation, the harmonisation of prices and taxation as well as logistics, railway reform and TEN-T infrastructures can be expected under a scenario of rapid institutional and policy integration supported by high economic growth. Economic sluggishness and/or setbacks with regard to institutional reform following the variable geometry or core/periphery rationale would diminish these positive impacts or slow down their trajectory.

4.3.2 Indicators

For each of the eight external policy domains discussed in section 4.3.1 the FORESIGHT for TRANSPORT study has identified and described indicators for tapping developments over time. These are covered by the FORESIGHT for TRANSPORT monitoring system (Deliverable 8) which is available as an access databank.

The selection of indicators was made with reference to the key or critical factors for each external domain as outlined above and validated through the project's Delphi survey (Deliverable 7) and based on the state-of-the-art literature and policy documentation.

Each external policy domain is associated with at least six indicators. No a priori prioritisation of these indicators is possible. Depending on the transport impact pathway under investigation different indicators might be relevant to consider as background information on the external policy domain under consideration or as explanatory and/or intermediary variables in specific cause and effect relationships.

4.3.2.1 Demographics

Annual population growth by 1,000 is a standard demographic indicator and one available for all EU Member States at country and regional level. Long-term estimations of population growth are based on trend analyses of fertility rates (expressed as the average number of children born to women during the reproductive years), life expectancy (measured at birth and at the age of 65) as well as net migration, where net migration corresponds to the difference between emigration and immigration for any particular country. Health policy drives life expectancy whereas family policy as well as labour market policy (in particular with regard to the participation of women in the labour market and the availability of childcare facilities or children benefits) influence fertility rates. Net migration is determined by levels of economic development and migration policy.

4.3.2.2 Attitudes

Research on attitudes is very widespread in modern societies and attitudinal surveys are often used to inform political decisions on various issues. The Eurobarometer and World Values Survey are good examples of this trend. Several social statistical surveys like the Survey on Income and Living Conditions or the Household Expenditure and Consumer Surveys[11] often also include a set of subjective questions that allow the analysis of attitudinal trends against material conditions.

In other words, it is today possible to obtain quite a comprehensive picture on what different population segments may think about issues like the environment, technology or time and speed which, as discussed in section 4.3.1.2, are relevant for charting how attitudes impact on transport and mobility. In the meantime we also find in several countries surveys primarily dealing with time use and mobility. Examples are the German Travel Survey Kontiv and the Dutch Survey of Travelling Behaviour OVG.

If we however also understand attitudes to refer to broader socio-cultural changes – to which scholars studying attitudes often attribute changes in specific attitudes and related behaviour – then it is relevant to also consider analytical perspectives such as those on post-materialism (Inglehart 1977) or social capital (Putnam 2000). The theory of post-materialism argues that in affluent societies individuals tend to gradually shift their attention away from personal and economic security to considerations about the quality of life. This, in turn, explains the increasing significance in terms of agenda-setting of social movements such as environmental citizen associations. In parallel with this development we can however observe a weakening of social networks. This feeds the increasing general distrust vis-à-vis social and political institutions and

the unwillingness of large population segments to see through a range of policy reforms.

It is not least because of such rather contradictory processes that caution is called for with regard to the interpretation of the results of attitudinal surveys. To this must be added the knowledge from social psychology that attitudes are not always consistent with behaviour. For instance, the preference for the car as a means of mobility[12] persists despite the increase of environmentally-friendly attitudes and in part explains the large elasticity of pricing / taxation measures implemented to curve demand. The other main reason why positive attitudes towards the environment, however widespread, do not lead to changes in behaviour is the lack of an adequate offer from public transport.

Overall we can say that attitudes are slow to change and even slower to effect changes in behaviour. This must be kept in mind when modelling attitudinal changes in strategic transport modelling but also when implementing local policies to support the shift to environmentally-friendly modes of transport. A key to the success of such local policies lies with their persistence.

4.3.2.3 Social developments

Social statistics are a well developed field of monitoring and observation both at the European level and at the national level. Social reporting lags somewhat behind at the sub-national level – especially in small countries – as well as in the New Member States that have only recently began to run social surveys on income and living conditions, earnings and work, household expenditures or social protection.[13]

The flexibilisation of labour market conditions which was identified in section 4.3.1.3 as a key factor among social developments influencing mobility can be deduced from a review of employment and social protection legislation in several countries. Its effects are manifested in statistics showing a rise of part-time employment, occasional (non-permanent) forms of work, telework but also short-term unemployment. This must be assessed against more general labour market developments with regard to the size of the labour force and labour market participation rates as well as long-term unemployment. At present we observe a slow rise of the labour market force (in relation to economic growth) and a parallel stronger increase of long-term unemployment. That these trends are occurring even in times of economic growth suggest a decoupling of the latter from labour market demand. The contemporary flexible labour market is also a more competitive labour market. This is shown by the increasing labour market participation rates of women as well as the declining age at first job. In other words, people are entering the labour market later and are less likely to remain employed continuously or full-time over their lifetime. In conjunction with early retirement patterns this aggravates the already weakened financial

possibilities of social protection. Monitoring future developments in the social policy domain thus entails keeping a close eye on all of the above indicators, namely, employment rates, age at first job, the size of the labour force (in general and by economic sector), unemployment, part-time work, telework as well as retirement patterns.

Another social indicator of potential relevance for mobility is household size and typology as household arrangements (and more specifically whether people live alone or in larger families) influence mobility patterns and, especially, motorisation.

To the extent that social / regional cohesion is an explicit objective of the TEN-T network development, an indicator to consider is citizen access to basic services such as education, health care and public transport in peripheral and/or rural areas.

Finally, income distribution and associated measures of income inequality are of relevance for assessing ex-ante and/or ex-post the impact of pricing / taxation measures in the transport policy domain.

4.3.2.4 Institutional arrangements

Institutional arrangements are difficult to capture through measurable indicators. A number of qualitative indicators can however provide information on the two focal areas under this heading, namely the balance of powers between different levels of government and the democratic character of the emerging European polity and European institutions.

The number and scope of European directives – in general and by policy domain – are indicative of the increasing power of the European level of government as well as of policy harmonisation. The time between agenda setting, statute and implementation says something about the capacity of (European) institutions to effect policy reform (other than by setting specific themes on the policy agenda). Two sociological indicators on institutional capacity are the number and ratios of employees working for public administration at different levels of government and the diffusion of ICT within the latter.

At the political level, it remains unclear whether the EU will develop into a *state* political system. Even more contested is the extent to which federalism will inform this system. Two indicators provide information on these developments: first, the development of core European institutions, namely the European Commission, the Council and the Parliament, in relation to each other and more specifically with regard to the division or sharing of legislative and executive

powers and second, the evolving structure of legal entities at the sub-national level.

A major challenge regarding the European Union over the next couple of decades will be overcoming its current democratic deficit which is judged as at the root of its legitimacy deficit (European Commission 2002). Despite paying lip service to citizen participation and stakeholder involvement in policy-making the majority of the European institutions and policy domains (including transport) have still to implement institutional practices to address this deficit. Relevant policy measures, the implementation and performance of which ought to be monitored in the future, are as follows:

- Existence of a comprehensive information and communication policy. Information laws are generally important for establishing the legal framework for access to information but also have a symbolic value. Subsequently it is important to elaborate and implement a communication policy at sectoral level in accordance with the information needs of citizens as well as relevant stakeholders.

- Implementation of mechanisms to promote participatory (technology) assessment. In the transport policy domain of particular relevance are the mechanisms in place for environmental impact assessment as well as strategic environmental assessment.

The democratic performance of any society or policy domain inevitably also depends on the institutional capacity of civil society organisations and the democratic performance of major corporations, what is today referred to as corporate social responsibility.

4.3.2.5 Science and technology

Like social reporting, science and technology monitoring is an established field. In the statistical literature a distinction is often drawn between input and output indicators. Patents relating to technologies and publications relating to scientific results are the standard S&T output indicators. Input indicators are often thought more important especially with regard to the elaboration of long-term strategies. Such S&T input indicators include government and business expenditures on RTD as a percentage of GDP and public expenditures on education. Indicators that tap on the level of S&T potential in any country at any particular point in time are the distribution of highest educational attainment per country, RTD personnel per 1,000 and employment in high-tech industries.

The diffusion of new technologies or methods, such as e-commerce, can be measured through specific surveys that target firms and/or private households.

Investment into related technologies or infrastructures is a proxy of the rate of diffusion of such innovations.

4.3.2.6 Politics

Political culture and the character of politics as discussed in section 4.3.1.6 is captured by indicators such as the trust in political institutions at different levels, the length/time in political office and re-election rates, the development of the national and European party systems (and related to this the number of party members), electoral results as well as the degree and scope of mobilisation around specific 'single' issues as measured through protests or the formation of civil society organisations. An indirect measure of political capability among the citizenry is the average circulation of newspapers per 1,000 population and the dominant ownership patterns of the media sector. Many of these indicators are either not adequately developed in a comparative framework or only in part quantifiable.

The relevance of the above indicators for mobility and transport is indirect. These indicators do not measure any specific impact. In conjunction with information on attitudes and institutional arrangements they are however very informative with regard to what may constitute barriers in the implementation of policy reforms like those of the Common Transport Policy.

4.3.2.7 Environment and energy

The increasing significance of environmental issues in modern societies is among others shown by the consolidation of environmental monitoring systems and their diffusion in policy planning. An example is the 'Transport and Environment Reporting Mechanism' (TERM) of the European Environmental Agency. Most of the indicators listed below are now available for most EU countries – at least at the national level.

On the input energy side, relevant indicators to refer to include: energy intensity (as GDP produced with one unit of primary energy), final energy consumption (in total and by industrial sector), the share of renewable resources in final energy consumption, the share of transport and of different transport modes in total energy consumption as well as the share of oil, gas and electricity in total energy consumption.

In terms of the internalisation of external costs indicative are the average national prices for unleaded petrol and diesel, the tax share of petrol price, diesel price and alternative fuels as well as non-fuel taxation targeting air pollution.

Turning now to environmental degradation, it is useful to distinguish between waste, on the one hand, and emissions / pollutants, on the other hand. Waste indicators include the share of recycling, end-of-life vehicles, the number of scrapped vehicles per year, waste oil and waste tyres and more generally the exchange rate of the vehicle fleet. Environmental degradation indicators include the number and impact of environmental disasters, CO_2 emissions of different sectors, the total CO_2 emissions per country and the transport share, emissions of air pollutants by transport mode, the average size of non-fragmented land and the share of land with acidification exeedance.

4.3.2.8 Economy

The economic indicators mostly used in transport and other analyses are the annual growth of GDP (at constant prices) – in general and per economic sector – and trade (imports and exports per country). Equally important for designing transport logistic strategies or deciding about transport infrastructure investments are indicators that provide information on the structure and spatial organisation of economic activities like the share of industry / agriculture / services in GDP, the share of small- and medium-size enterprises or the share of logistics and distribution in production costs.[14]

4.3.3 Transport impact pathways

Section 4.3.1 has outlined the way in which external factors impact on transport and mobility. These may be further detailed at the micro-level with the help of the so-called transport impact pathway (see also Deliverable 7).

The impact pathway can be described as a succession of interrelated variables ending with impact indicators.

- Impact indicators measure outcomes – in this case transport-related outcomes.
- The initial or generating factors may describe developments in the external non-transport environment (e.g. economy, demography, attitudes, etc.) or developments at the level of transport policy.
- Intermediate variables are variables which mediate the effect between initial or generating factors and their outcomes as measured by impact variables. They may mitigate or aggravate outcomes. Intermediate variables may, in turn, be classified into those which operate within the external environment, those which operate within the transport system and

those which operate at the interface between the external environment and the transport system.

The complexity of transport impact pathways derives from the scope of impacts in terms of space or time as well as transport segment (long-distance freight; short-distance passenger, etc.) but also the evolution of the external context – alone or in relation to intermediate variables – over time. Given that changes over time need neither be synchronous nor consistent with each other, interdependencies must also be considered. These are often referred to as feedback loops.

Two examples can be used to illustrate the concept of the impact pathway.

Example 1. Economic growth and freight transport demand
It is well-known that the demand for freight is influenced by economic growth through the latter's impact on trade:

Economic growth ➔ Trade → Freight transport demand

This pathway is obviously too simplistic as economic growth affects transport demand in a way which is far more complex. A key intermediate variable in this connection is the structure of the economy (and how this is affected by economic growth). How the volume of trade impacts on freight transport demand will, in turn, be affected by the logistical organisation of transport services in terms of sourcing, production and distribution. Furthermore, the logistical organisation represents itself a complex system involving several trade-offs between production, distribution and transport costs as well as quality requirements. At the same time it is continuously changing. For instance, over the recent years we can observe a re-organisation within large firms towards concentration and specialisation at the supra-national level. Logistical changes are quite complex and involve different types of strategic and tactical decisions with implications for the transport system and hence also freight transport demand in the short- and longer-term.

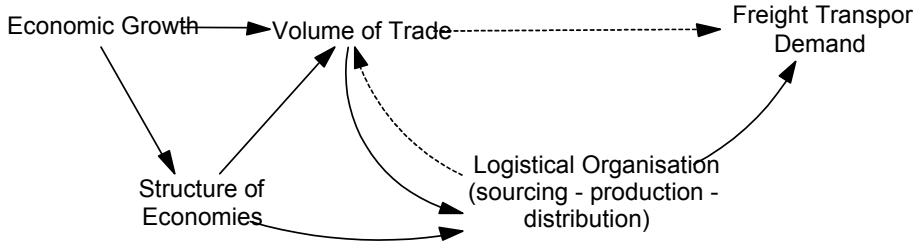

Figure 3a. Example 1 transport impact pathway

Example 2. Ageing and leisure patterns

Ageing affects the transport system through its impact on the structure and patterns of leisure activities. Contemporary older cohorts are more interested in travelling in their leisure time. This will result in an increase of demand for collective forms of transport by road and air.

A first simple cause-effect description of the above pathway could be represented by the following diagram:

Ageing ➔ Leisure travels ➔ Traffic (road & rail)

More complex mobility patterns are however in operation. Older people show more variable habits in terms of mobility than in earlier times. New aged cohorts are used to travelling more and can be characterised by a high degree of mobility. This is possible due to higher than average income revenues.

Even if collective public transports such as rail are not currently preferred by older people, this could change with significant improvements in terms of quality (comfort, accessibility, etc.) and adapted tariffs. A better representation of the pathway is thus represented by the following diagram.

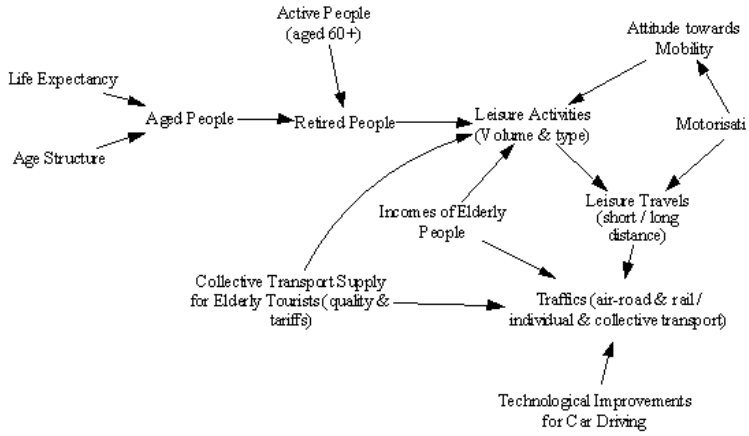

Figure 3b. Example 2 of transport impact pathway

In the FORESIGHT for transport project a number of additional transport impact pathways were examined, laying particular attention on initial or generating factors that emerge from external non-transport policy domains. These impact pathways were validated through the FORESIGHT for TRANSPORT Delphi survey and refined in the course of the second consultation round with external experts.

Each pathway was elaborated with reference to statements. These statements were presented to the external experts in the course of the Delphi survey.

For each critical pathway we distinguish between:

- ***Scope***: to specify for what transport segment the impact pathway is more relevant.
- ***External determining variables***: to specify which variable / driving factor from among the non-transport dimensions considered by the project is effecting possible changes on mobility and the transport system.
- ***Transport impact***: to specify what transport-related impacts can be expected from the external determining variables.
- ***Intermediate variables***: to specify which variables may mediate the above link (between external determining variables and transport impacts). This is an important element as most of the effects examined between external variables and transport are of the indirect nature. Intermediate variables may mitigate or aggravate the effects described. The intermediate variables are in turn classified into those which operate within the external environment, those which operate within the transport system and those which operate at the interface between the external environment and the transport system.
- ***Modes of intervention***: these mostly can be deduced from the specification of intermediate variables.
- ***Key actors***: those actors which would have a role to play in implementing specific policy and other measures or interventions.

In what follows we present the most important transport impact pathways identified by our study.

4.3.3.1 Ageing and the labour market

Ageing will affect mobility through its impact on the labour market. In view of the contemporary ageing trends we can expect a higher rate of persons aged 60+ to remain active in the labour market. Assuming that a) labour market demand grows in the future and b) technological developments are not such that this increase in labour supply can be absorbed by teleworking thus having a neutral impact on mobility, we can expect ageing to generate a higher transport demand for daily passenger transport

Scope
Short-distance (urban) passenger transport.

External determining variables
Ageing of population in combination with lower fertility rates *leading to*
A higher rate of elderly persons (60+) in the labour market or informal work.

Transport impact

Leads to an increase of transport demand for passenger transport (in terms of number of trips) leading, in turn, to greater traffic and congestion. This then contributes to increasing environmental externalities – local emissions in particular.

Intermediate variables

Within external environment

- Insecurity of pension schemes and / or labour market supports the trend towards more elderly persons working longer or engaged in informal work.

Within transport impact pathway

- A competitive public transport could absorb the increased demand for passenger transport thus mitigating the negative results of an increase in the number of trips.

Interface between external environment and transport

- Teleworking is very likely to increase, however it is doubtful whether this will mitigate or aggravate the above impacts. It could lead to a reduction of trips (or their stabilisation despite an increase of demand) but also to an increase in their number.

Modes of intervention

Family policy
Labour market policy
Pension reform
Investment into quality and capacity of public transport
Firm organisation / management strategies concerning teleworking and transport plans

Key actors

State, Pension funds, Trade unions, Employers' organisations, Enterprises

4.3.3.2 Ageing and leisure patterns

Ageing will affect the transport system through its impact on the structure and patterns of leisure activities. Contemporary older cohorts are more interested in travelling in their leisure time. In view of the current ageing trends, this will result in an increase of demand for collective forms of transport by road and air.

Scope

Long- and medium-distance passenger transport.

External determining variables

Ageing of population results in more free / leisure time on average and on the aggregate.

Transport impact
Leads to an increase of trips (for leisure). Modal split in this segment continues to be in favour of road / air. Both these effects contribute to increase environmental externalities – global emissions.

Intermediate variables
Within external environment
- Degree of affluence of elderly people.

Within transport impact pathway
- Extent to which we might observe fewer long-distance journeys replacing short-distance journeys, in which case the impacts will be different for short- or medium-distance passenger transport and long-distance passport.
- Development of railway as a competitor to road / air for segment 300 to 700 km and relating to needs of elderly tourists (having more time but expecting more comfort and quality).

Modes of intervention
Improving price-quality relation of railways for leisure travel targeting the elderly.

Key actors
Railway companies and tourist agencies.

4.3.3.3 Migration policy and border control

Restrictive migration policies vis-à-vis non-EU countries will result in an increase of controls at the external borders of the Union in the East. This is expected to create new bottlenecks for freight transport in and out of the new European Union borders. This will lead to a increase in travel times and thus a decrease of transport efficiency.

Scope
Long-distance freight transport.

External determining variable
Restrictive migration policies.

Transport impact
Leads to an increase of waiting times at external borders, hence travel times. This leads, in turn, to a decrease in transport efficiency. However it could also contribute to decreasing road competitiveness vis-à-vis railways.

Intermediate variables
Interface between external environment and transport

- Removal of borders (and border controls) in conjunction with network development within EU is likely to facilitate traffic, hence also reduce travel time. Thus the net effect might be negligible.

4.3.3.4 Valorisation of time and speed and daily mobility

In view of contemporary attitudes to time and speed, we can expect transport users to demand high levels of mobility and prioritise high-speed modes of transport. Assuming that negative views of public transport prevail, this can be expected to contribute to a continuing increase of the motorisation rate. Assuming a low degree of green technology development and uptake within the car industry, this will lead to an increase of negative environmental externalities despite the decrease of travel times out of higher-power motor vehicles.

Scope
Short-distance (urban) passenger transport.

External determining variable
Valorisation of time and speed.

Transport impact
Leads to an increase of the motorisation rate and, in turn, to the increase of traffic / congestion and environmental externalities – local emissions in particular.

Intermediate variables
At interface between external environment and transport

- Attitudes towards public transport. If public transport is improved in terms of speed and quality, then attitudes to public transport could 'break' the trend towards more motorisation without questioning the general attitude towards speed and time.
- Green technology uptake. The uptake of greener cars could mitigate the negative environmental extenalities despite increasing motorisation rate.
- Higher-power vehicles. A diffusion of such cars would lead to an increase of emissions per km driven but could also lead to savings of travel time. If this 'extra time' is invested in additional trips then the result is overall negative, if not the impact may be balanced. (The expert group was of the opinion that the former is more likely to occur, i.e. extra time gained would be invested in additional trips).

Modes of intervention
A strong regulatory / investment policy towards improving public transport in conjunction with better 'image politics' (public relations) for public transport. Promotion of green technology uptake by making green cars cheaper. Establishment of green car zones in cities or of social innovations involving

organised car-sharing in cities or flexible 'pay-as-you-go' types of arrangements.
Regulation or advertising against higher-power vehicles in cities (comparable to regulation or advertising for smoking or campaigns against speeding in traffic).

Key actors
State / cities (in terms of investment in public transport) or the provision of incentives / RTD into promoting uptake of green technology or diffusion of social innovations.
Car industry (in terms of making green cars cheaper).
Public transport operators.

4.3.3.5 Valorisation of time and speed and tourism / business travel

In view of contemporary attitudes to time and speed, we can expect transport users to demand high levels of mobility and prioritise high-speed modes of transport. Assuming that high-speed long-distance rail passenger transport stagnates, this will mean that people will favour road and air transport over long distances.

Scope
Long-distance passenger transport. It is necessary to subdivide this segment, since the distances over which cars, high-speed rail and air travel compete are limited: the 300 to 700 km distance is thus the most relevant. The strength of the competition also varies according to the travel purpose (business, leisure, etc.) and population segment (families, elderly, singe persons). The group discussions focused mostly on tourism.

External determining variable
Valorisation of time / speed and flexibility at the destination of tourist travel.

Transport impact
Supports the use of the car for the long-distance leg of the trip in order to enjoy flexibility in moving around at the destination. This in turn contributes to negative environmental externalities, both local and global.

Intermediate variables
At the interface between external and transport environment.

- Availability of rail-based vacation packages including access to cheap, convenient and environmentally-friendly vehicles at the destination (e.g. smart cars). Conventional car rentals are generally too expensive to fulfil this need.
- If the apparent valorisation of time / speed is in fact a valorisation of flexibility, then perhaps there is a market for marketing rail travel for being a slow mode rather than a fast one.

- The increasing availability of low cost airlines (not only through low cost airlines but increasingly also discounts offered by traditional carriers) will influence the attitudes towards what types of destinations are accessible for tourism.

Modes of intervention
New forms of collaboration between railways and the car industry for specific tourist destinations.
Opening up of railways to new segments / forms of tourist travel.

Key actors
Alliances between railway operators, city administrations and the car industry.

4.3.3.6 Environmental concerns

The majority of Europeans think that environmental protection is a key policy priority. Assuming that attitudes also translate into a change of behaviour, this can be expected to lead to the greater use of environmentally-friendly modes of transport and to increased pressure for the modernisation of public transport. In the medium- to longer-term this will lead to less congestion on the roads, a modal shift towards more environmentally-friendly modes of transport and by consequence lower local (NOx) and CO_2 emission levels.

Scope
Short- and long-distance passenger transport.

Determining external variable
Positive attitudes to environmental protection leading to behavioural changes.

Transport impact
Leads to use of environmentally-friendly modes of transport. This results in lowering the motorisation rate and re-balancing the modal split; subsequently, to the reduction of negative environmental externalities.

Intermediate variables
Within external environment
It is well known from research that there is often a weak correlation / link between attitudes and specific behaviour and that people can live with dissonance. However it is also possible to view this contradiction not as some form of irrationality but rather a 'social dilemma' type of problem.
One cause for this may be the absence of environmentally-friendly alternatives. The structure of the dilemma may in this case be changed by providing such alternatives.
In other cases people may have mistaken perceptions regarding the real costs involved in their travel choices or they know too little about alternatives or are

not aware of the environmental implications of their own key lifestyle choices (e.g. settling in a family).

Modes of intervention
Provide practical opportunities to break existing habits, because changes in attitudes are often a factor accompanying changes in practices or lifestyles rather than a driver of these. Provide more accurate or complete information about actual costs of driving cars – through national information campaigns or marketing by public transport companies. Promote practical experiments where individuals are given the opportunity to familiarise themselves with more green travel choices. Provide incentives for people who consider their travel behaviour as part of general promotions of greener lifestyles.

Key actors
Local authorities, local companies / agencies and local user groups.
There are mixed results from experiences so far, as habits are hard to change. The key appears to be first and foremost providing structural conditions that enable changes in both attitudes and practices away from full dependence on car use.

4.3.3.7 Changing household structures

Changing household structures result in the decrease of the average household size. This results in a lower car occupancy. Assuming that (a) the motorisation rate continues to increase and (b) car-sharing schemes do not increase in significance, we can expect the changing household structures to lead to higher traffic densities in urban and suburban environments.

Scope
Short-distance (urban) passenger transport.

External determining variables
Decreasing household size as a result of ageing of population, lower fertility rates and changing household / family patterns.

Transport impact
Leads to increased motorisation rate and hence to increase of traffic densities, congestion and, subsequently, negative environmental externalities (local emissions).

Intermediate variables
Within external environment and at interface with transport

- Reversal or stabilisation of current trend towards more single households due to younger people staying longer with their parents or living in shared households with other young people (and sharing a car).

- Flexible working schemes, on the other hand, make car sharing schemes more difficult.

Within transport impact pathway

- Motorisation rates relate in the first place on location and income.

Modes of intervention

Promotion of low-cost car sharing schemes for young people living together or families with older children.

Key actors

Car sharing scheme operators, city administrations.

4.3.3.8 Flexibilisation of labour market

The flexibilization of the labour markets and especially the increase of the share of telework can be expected to directly influence the transport system by reducing the demand for short-distance transport.

Scope

Short-distance passenger transport.

External determining variables

Flexibilisation of labour markets.

Transport impact

Unclear whether this leads to more or less short-distance journeys to work.

More short-distance journeys would lead to more congestion and environmental externalities. Less short-distance journeys would curve congestion and environmental externalities.

In any case we may expect changes in the pattern of peak hours. If the aggregate number of journeys remains more or less the same, then their more balanced distribution during the day may still result in less congestion.

Intermediate variables

Interface between external environment and transport

- Telework could lead to less journeys (people stay at home to work, thus the overall number of trips is reduced) OR the gained flexibility leads to more short-distance journeys (for private purposes) and longer distance journeys related to work (as possibility of telework might encourage people to live further away from work).
- Depends on working schemes in the framework of telework (half day schemes or 3-day per week schemes).
- Flexibilisation also means that journeys to work become more diverse (to different branches, clients, etc.)
- Quality of travel (for instance in trains).

Modes of intervention
Promoting day-schemes in terms of telework (rather than half-day schemes).
Telework as a means of better 'work logistics'.

Key actors
Firms and legislator providing incentives for 'work logistics'.

4.3.3.9 Flexibility in working hours

The reduction or increased flexibility of working hours can be expected to directly influence the transport system in that it will influence the temporal demand for short-distance (throughout the day). As a result the phenomenon of peak-hour traffic as we today know it will weaken.

Scope
Short-distance passenger transport.

External determining variables
Reduction of working hours.
Flexibility of working hours.

Transport impact
Leads to a reduction or more balanced distribution of number of journeys and, in turn, to less traffic / congestion and a reduction of environmental externalities.

Intermediate variables
Within external environment
- The trend towards the reduction of working hours might be short-lived; the opposite trend might be coming up.

Interface between external environment and transport impact
- Flexibility could weaken peak-hour traffic if overall number of journeys does not change significantly, otherwise there is the danger of a 24-hour peak-hour.

4.3.3.10 Greater power for European level of decision-making

The gradual Europeanization of policy towards greater power for the European level of decision-making will among others affect the level of transport investment, especially for railway projects that are part of the TEN-T network

Scope
Long-distance freight transport.

External determining variable
European integration leads to greater power for the European-level of policy-making, including in terms of budget. Investment priorities are oriented towards key links / cross-border projects and railways or intermodal solutions.

Transport impact
Affects network development towards multi- and intermodality. This increases the efficiency of the transport system, leads to a re-balancing of modal split, helps correct for market distortions and eventually to a reduction of both congestion and negative environmental externalities.
Second-round impact. If investment priorities end up being oriented primarily towards long-distance links also at the national level, then this could result in lack of funding for national / regional projects leading to a deterioration of regional networks.

Intermediate variables
Within external environment
- Extent to which EU funding really does prioritise multi- and intermodality and in that also railway investment.
- Share of European funding – 10 as opposed to 30 per cent.
- Availability of national funding for 'European' projects.
- Subsidiarity and coordination of decisions between European, national and sub-national levels.
- Integration of 'European' projects in transport plans at national / regional / local level. If these are appropriated as local projects as well, then the declaration of such projects as of 'European interest' can assist in their implementation.
- Role granted to counter-expertise developed by single-issue resident and/or environmental movements. Mobilisation against the construction of infrastructure projects can arrest implementation.

Modes of intervention
Modes of multilevel governance regarding both planning, design and implementation of projects, including their assessment and risk / finance sharing.
Promotion of participation / public enquiries modalities to involve resident populations and environmental movements.

Key actors
'European' coordinators of projects (cf. van Miert policy recommendations).

4.3.3.11 Towards a re-orientation of European transport policy?

The Transport Acquis has till now mostly dealt with internal market regulations. In the future we can expect a re-orientation of the European transport policy

towards regulations that seek to correct for distortions in market competition and consolidate environmental standards. This will in the medium-term lead to the internalisation of environmental costs and a decrease in the contribution of transport to environmental damage.
The new White Paper on the European Transport Policy (till 2010) has two overarching goals. First, to decrease congestion and second, to effect a significant modal shift from road to rail. The achievement of these goals is expected to contribute to the achievement of sustainable mobility. Achieving these goals will involve the implementation of pricing measures (especially targeting road), the revitalisation of alternative modes of transport (hence rail) and targeted investment in the TEN-T network.

Scope
Long-distance freight transport.
Urban transport.

Determining variable (within transport policy)
Implementation of pricing (primarily for road).
Revitalisation of alternative modes of transport (railways).
Targeted investment in TEN-T network.

Transport impact
Corrects for market distortions, leading to a modal shift from road to rail and, subsequently, to a decrease of congestion and negative environmental externalities.
Second-round effect considerations. What are the implications of road pricing involving internalisation of environmental costs for other forms of environmental taxation? Likewise with the earmarking of revenues for transport investment. Does this change the strategic orientation of other non-transport policies and, if so, with what effect for transport of fiscal policy in general?

Intermediate variables
Within transport policy environment
- Difficulties to calculate true or optimal environmental cost (with reference to pricing measures) leading to the design of inefficient pricing regimes which do not achieve their original aim.
- Difficulties to design, agree on and implement pricing policies that lead to internalisation of environmental costs and/or the use of revenues from road pricing. Agreement here is difficult because of differences across or within Member States as well as stakeholder groups (for instance road lobbies).
- Differences in national priorities concerning the use of particular policy tools (for instance pricing) arresting implementation of pricing policies.
- Divisions of responsibilities between central and local government concerning pricing policies arresting implementation of pricing policies.
- Limited public acceptance of new pricing schemes arresting implementation of pricing policies.

- One reinforcing factor may be an increased harmonisation in the regulation of competition policies and the better coordination of these with social policies. For instance, an increased acceptance of a European social agenda may help pave the way for environmental internalisation measures.
- Degree of organisation / alliances between professional transport organisations that may benefit from internalization (e.g. rail freight, intermodal terminals) as a counter-balance to road lobbies.

Modes of intervention
Strengthening the coordination of economic and social objectives / policies would benefit the sustainability debate also regarding the environment.
Set up of strong intermodal organisations.
Enhance participatory / consultation procedures that can help enhance policy deliberation and possibly increase acceptance of new pricing and internalisation policies.

Key actors
National, regional and local governments
Transport organisations
Environmental movements
Civil society.

4.3.3.12 More power for the cities in urban transport?

Within the European multilevel governance context, responsibility for urban transport has been shifting to city administrations and at this level there has been intensive inter-city exchange of information. The general trend with regard to urban transport is towards city logistics and public transport

Scope
Urban passenger and freight transport.

Determining variable (within transport policy)
Responsibility for urban transport shifting to city authorities.
Exchange of information among cities supported by European policy framework.

Transport impact
Leads to implementation of policies supporting city logistics (concerning freight) and support for public transport (concerning passengers) in view of major problems faced in cities regarding congestion and environmental pollution.
Second round / trade-off effect. Models of sustainable cities resting on top-down control / regulation of transport system might lead to monopoly situations regarding freight which, in turn, might work against competition or reduce choices for customers.

Intermediate variables

At interface between transport policy and transport impact

The implementation of policies that support sustainable mobility at city level depend on a range of other factors:

- Ownership of infrastructure
- Regulatory influence on traffic flows
- Market structures / organisation regarding delivery of goods
- Deregulation / privatisation – this may lead to reductions in costs and better management of flows but it can also decrease strategic control of the system because of outsourcing.
- Definition of public service and role of city regulator in this respect.
- Available funding for investments
- Strength of trade unions
- Relative prices of public transport as compared to car.
- Public acceptability

4.3.3.13 Technological innovation and diffusion

Technological innovation affects transport insofar as it is used to support better coordinate and develop 'avoid-transport' technologies like videoconferencing etc. In this sense, technology will, on the one hand, provide coordinating mechanisms to ensure punctuality and accurate travelling times and on the other hand, reduce the need to travel. The overall consequence is that the whole transport system will be less congested

Technological development in the area of mobile computing will allow people to "wear a virtual office". Smaller laptops, PDA, mobile connectivity will continue improving as there is a clear demand for these services. In this sense, we can expect that people will demand more secure travelling, with accurate information on connections and punctuality, even if these require that the average time spent for a travel increases

The following remarks relate generally to the impact of technology on transport.

Scope

Passenger and freight transport (primarily long-distance).

External determining variables

Technology design (innovation).
Stock and commodity management (technology facilitating management).
ICT in personal and occupational context.

Transport impact

Contributes to 'avoid-transport' or to reduce transport demand. Both have economic and environmental effects.

With reference to ICT in personal and occupational context, the available evidence is still non-conclusive as to whether the flexibility gained leads to a real reduction or to substitution.

Intermediate variables

Within external environment (general)

- Political stability (for instance with regard to oil availability and prices)
- Environmental pressures (actual or through citizen mobilisation)
- Market structures (centralisation?)
- Scale of global purchasing
- Scale of just-in-time production

Within external environment (technology)

- Support and scope of RTD (renewables, track/trace, organisation of real time technologies?)
- Price and efficiency of new technologies ICT / GPS / Radio Frequency ID (RFID)

Modes of intervention & key actors

Technology management
Research and demonstration
Information campaigns

4.3.3.14 Continuing trends regarding RES and RUE

Total and transport energy consumption continues to grow. Assuming that a) the share of renewable energy remains low, b) there are no major breakthroughs regarding transport technology c) the motorisation rate remains stable at a high level or continues to grow in the EU15. we can expect an increase of environmental pollution (especially CO2 emissions) due to transport

Scope

Short- and long-distance freight / passenger transport.

External determining variables

Share of renewable energy remains low.
No major technological breakthroughs.

Transport impact

Environmental pollution due to transport increases (local and global emissions, use of resources, habitat fragmentation etc.)

Intermediate variables

Within transport policy

- Internationalisation of environmental costs (with public acceptance and political will).

- Improvement of public transport capacity / quality resulting in saturation / decline of motorisation rates.

Modes of intervention
Internalisation of environmental costs through pricing and other policy measures (not alone transport)
Investment in public transport

Key actors
European, national and sub-national governments

4.3.3.15 Technological improvements and alternative fuels

Assuming current mobility trends, NOx and other emissions continue to decrease through the introduction of technological improvements (such as better catalytic converters) or a growth in the share of alternative fuels

Scope
Long- and short-distance passenger / freight

External determining variables
Technological improvements (such as better catalytic converters)
Increase of share of alternative fuels

Transport impact
Reduction of local emissions, energy consumption.
Impact also on transport costs as well as resource consumption budgets.

Intermediate variables
Within external environment
Uptake of related technologies and diffusion of alternative fuels (by industry / society)
Within transport environment
Transport policy (regulation, pricing, research) supporting of technologies, alternative fuels both at the industrial / societal level.
Increase of fuel prices
Environmental taxation

Modes of intervention & key actors
Research and technology
Industry
Legislator

4.3.3.16 Conflicts on land use

Assuming current trends, more conflicts can be expected between alternative land uses, with transport infrastructure competing with other uses, such as nature conservation, urban environment and other forms of transport.

Scope
Long and short-distance freight / passenger

External determining variable
Conflicts on alternative land uses

Transport impact
Influences network development, financing regimes for transport infrastructure, quality of transport and, in turn, impacts on environment (on various ways depending on network development).

Intermediate variables
Within external environment
- Political processes, for instance with reference to EIA / SEA
- Awareness / participation processes (of citizens)

Within transport environment
- Cross-sectoral integration of policies in the framework of say SEA enabling to optimise the use of existing infrastructure

Modes of intervention
Strategic environmental assessment
Consensus conferences

Key actors
City / regional councils
Infrastructure developers
Citizen representatives

4.3.3.17 Increase of trade and infrastructure needs

Economic growth induced by enlargement will give a new impulse to European trade and hence long-distance freight transport as well as inter-European tourism, hence long-distance passenger transport. Assuming that the current prioritisation by new Member States of road transport comes to dominate, this will lead to an increase of the share of road in long-distance freight and passenger transport between East and West
Assuming that the economies in the new Member States will continue to grow and recognizing the significant increase in motorisation rate, we can expect that

infrastructure capacity will become a major problem in the new Member States, since infrastructure is neither adequate in length nor in quality in order to serve a much higher traffic volume

Scope
Long distance freight and passenger transport

External determining variable
Economic growth induced by enlargement leading to an increase of trade between East and West

Transport impact
Leads to increased demand for passenger and freight transport (in terms of trips, traffic), to an increased motorisation rate and to a modal shift in favour of road. Capacity problems increase and so do negative environmental externalities. This might result in more investment in road (considering investment deficits in the new Member States over the last fifty years) aggravating above effects.

Intermediate variables
At the interface between external and transport environment – transport policy
- European investment priorities, including in the framework of Structural / Cohesion Funds, supporting rail investment
- Collaboration between rail and road operators in terms of logistics and mobility / freight management.

Modes of intervention
European-wide rail freight corridors
Logistic centres and re-organisation of long-distance logistic chains

Key actors
'European coordinators' of TEN-T corridor developments
Structural Funds
Railway and road operators

4.3.3.18 Growth of transport demand

Individual demand for transport will continue to increase in line with GDP in the EU15 due to higher wages and the fact that people spend more or less the same percentage of their disposable income on transport. Freight transport will also grow due to increased economic activity. This is assuming that there is no major technological innovation that breaks the close association between economic and transport growth and no major shift in behavioural patterns
Assuming contemporary trends in GDP growth and no major changes with regard to transport policy, technological innovation and individual mobility

patterns, the modal share of road and air will continue to dominate in the EU15. The share of rail and alternative modes of transport will stagnate or decrease. In the Member States, the modal share of cars will keep growing significantly

Scope
Short- and long-distance passenger transport
Long-distance freight transport

External determining variable
Economic growth leading to more trade as well as to an increase of household disposable income.

Transport impact
Leads to generation of transport demand (freight and passengers) and, in turn, an increase of motorisation rate, modal shift in favour of road (resulting in capacity problems / congestion) and negative environmental externalities.
In terms of passengers, the impact is likely to be weaker for short-distance transport as compared to long-distance transport (both leisure and business).

Intermediate variables
For passengers at interface between external and transport environment
- Saturation of car ownership weakens the GDP / revenue – transport link
- Urban sprawl

For freight at interface between external and transport environment
- Sourcing patterns
- Spatial distribution of economic activities
- Degree of organisation / optimisation of logistic and transport chains, massification of flows at national and local level
- Opening of Europe-wide rail freight corridors

General
- Technological innovations regarding transport (greener cars, combustion engines)
- Renewable energy
- Rational use of energy
- Energy prices

Modes of intervention
For short-distance passenger transport
Availability / accessibility of public transport or transport by rail (for city agglomerations)
Availability of parking facilities close to railway stations
For long-distance passenger transport
Enhance participatory / consultation procedures that can help enhance policy deliberation and possible increase acceptance of new pricing and internalisation policies.

For freight transport
Organisation / optimisation of logistic and transport chains
General
Changes in energy sector regarding both source and use of energy
Energy prices
New transport technologies

Key actors
State, transport operators, city / regional authorities, Energy providers

4.3.4 Reference scenario

The relationships between external factors, on the one hand, and mobility and transport on the other, that were described in the previous section are also captured by global scenarios on the future. Such global scenarios cluster relevant relationships at the aggregate level rather than individual indicators across impact pathways. We begin by considering the reference scenario and discuss a series of contemporary trends and their future development. Subsequently we discuss a number of alternative scenarios.

The global reference scenario was specified with reference to the thematic scenarios elaborated by the experts of the first consultation round (see section 4.2.5) and validated through the FORESIGHT Delphi survey. Respondents to the Delphi survey were asked to assess these thematic scenarios in terms of likelihood and desirability (see Deliverable 7). The reference scenario represents the cluster of those thematic scenarios corresponding to specific policy domains which were assessed as most likely.

Table 1. Reference (most likely) scenarios

Demography	Ageing of population
Attitudes	Individualism prevails
Social developments	Laissez-faire social policy, increase of inequality
Institutional arrangements	Re-assertion of nation state (variable geometry) or Federal State Europe
Technology	Low level of innovation; incremental changes
Political	Elite closure and technocracy under federalism
Environment	Weak sustainability (technology / economy)
Economy	Stabilisation at a fairly low level of growth
Transport	Increasing transport demand and motorisation; weak internalization of external costs; congestion and environmental problems persist.

Source: Delphi survey, Waves 1 and 2

Analytically, the global reference scenario can be described as follows. Trends along each dimension are illustrated with reference to specific benchmarking indicators for which information is available and has been assembled.

Demographically, we live in an ageing society with a comparatively high regional variation at the global level (less so within the European space).

- Over the last 30 years the share of persons in the age range 60+ in the European Union has grown by over 40 per cent, representing an average 1.3 per cent annual increase. A similar trend can be observed in the new Member States since 1996.
- Life expectancy at 65 in 1990 was 14 years for men and 18 years for women. By 2000 this had increased by one year respectively.
- In most European countries population has tended to increase only very slowly. Between 1990 and 2000 the population in the EU-15 has increased by 3.5 per cent. In the New Member States there has been a clear trend of decreasing population between 1995 and 1999. The average annual population change for CEC regions has been –0.27 per cent.
- Net migration per 1,000 of the population of the EU-15 decreased from around 3 to 2 between 1990 and 2000

Attitudes tend towards individualism with an emphasis on consumerism, self-interest and a positive view of technology and speed. Group orientations, when they emerge, tend to be very local and issue-based.

- European citizens prioritise high-speed and subsequently high-speed travel. This is evidenced, among others, by car manufacturing. Between 1990 and 2000, the average power of new passenger car registrations in the EU rose from 52.3 KW to 62.8 KW in 2000 which represents an increase by 20 per cent.
- Another indicator of preference for speed is the diffusion of high-speed train (HST). HST lines traffic tripled during the 1990s.

The trends with regard to the **social agenda** point towards a predominance of the laissez-faire approach with increasing flexiblisation in the labour market, decreasing welfare expenditures and higher levels of inequality.

- The increase of the flexibility of labour markets is reflected in the increase of part-time work. In the European Union the number of employees working less than 30 hours per week has increased from 13.3 per cent in 1990 to 16.4 per cent in 1999, thus showing an annual average increase of 2.3 per cent.
- One per cent of the working population in 2000 was teleworking full-time. A further four per cent was teleworking on an occasional basis. The rate of increase is estimated at 10 per cent per year on average.
- Between 1998 and 2000, the employment rates of persons aged 15-64 in the EU and Candidate countries increased by only 2 per cent.

Institutionally the European Union finds itself at a key turning point, with enlargement and institutional reforms underway. The success and impacts of the latter remain unclear.

- The gradual emergence of the European supra-national polity means that today more than 50 per cent of national legislation follows European directives. However, key areas for statehood like fiscal policy, social expenditures, justice and security as well as cultural affairs, continue to be national competencies.

At the **technological** front incremental changes and improvements are the order of the day. The problem appears to lie more with the diffusion and uptake of new technologies rather than with innovation, whereby the low expenditures in RTD, both from government and business, are in part to blame for this.

- From 1991 to 1999 R&D Expenditure in EU-15 stabilised between 1.5% and 2.0% of the GDP per year. In most countries it remained far below the minimum target of 2.0%, the preferred one being 2.5 to 3.0%.
- Between 1995 and 2000 in the EU-15, the percentage of people employed in high-tech and knowledge intensive services was increasing at an average rate of 2.9%.
- From 1990 to 1995, high tech patents in EU-15 grew by an average of 22 percent annually, albeit from a very low starting point.

Improvements with regard to the **environment** are sought through both economy and technological instruments. However, the low uptake of new technologies, on the one hand, and the low economic growth, on the other, make the introduction of strong ecological policy measures difficult.

- Final energy consumption grew by 16 per cent between 1985 and 1998 in the EU-15. This corresponds to an average annual increase of 1.2 per cent.
- The share of energy consumed by the transport sector increased from 28 to 36 per cent between 1985 to 1998. This corresponds to an average annual increase of 0.6 per cent.
- Between 1990 and 2000, the transport share of CO_2 emissions in the EU-15 increased from 21.6 to 25.2 per cent which corresponds to an annual average rate of increase of 1.7 per cent. In the new Member States, the respective share increased from 10.1 to 13.4. This corresponds to an annual average rate of increase of 3 per cent.
- Between 1990 and 2000 NO_X emissions in the EU-15 decreased by 27 per cent which corresponds to an annual average rate of decline of 2.7 per cent. In the new Member States there was a decrease by 41 per cent, albeit from a higher starting point.
- In 2002 road fuel was between 5 and 10 per cent cheaper than in 1980! After reaching their highest levels in 1985, fuel prices decreased considerably in the period 1985 to 1990. Since 1990 they have again been on the increase, albeit slowly. Between 1991 and 2000, fuel prices for unleaded petrol increased by 13.7 per cent in the EU-15 at constant prices.
- Between 1991 and 2000, fuel prices for diesel increased by 14,1 per cent at constant prices in the EU-15. This corresponds to an annual average increase of 1.6 per cent.
- In the period 1990-1999, land take by transport infrastructure was estimated to have been 10 ha per day for new motorway construction in the EU-15. In the new Member States, land take by transport infrastructure was estimated to have been 2 ha per day for new motorway construction during the same period. The motorway network has increased by more than 30 per cent between 1990 and 1999 which corresponds to an average yearly increase of 3 per cent.
- The share of renewable energies in the total primary energy consumption increased from 4.8 per cent in 1990 to 5.7 per cent in 2000 in the EU15. This corresponds to an average annual rate of increase of close to 2 per cent.

In terms of the **economy**, the present tends to a low level of GDP growth with stagnation in terms of international trade and the economic structures. This is however not a stable situation. A turn-around towards economic growth is possible.

- In the period 1995 to 2002 there was no clear trend regarding GDP growth in the EU-15. Between 1995 and 2000 the average GDP growth rate was between 2.4 and 3.5 per cent. Since 2002, the average GDP growth rate was one per cent.
- In the new Member States the average GDP growth rate in the mid-nineties was 6 per cent. At the beginning of the 21st century it was 2.1 per cent.

The situation is most unclear at the **political** front. At the crossroads of the European project of integration it remains unclear whether we are moving towards the consolidation of an open democratic system where politics are the arena for active citizenship or whether we are more likely to witness the beginning of an era of political polarisation, elite closure and technocracy.

Against this background, the **transport** present is characterised by high transport demand with the trend pointing towards: further growth; high levels of congestion and external negative effects; an increasing trend towards motorisation and, associated with this, a high level of injuries and fatalities.

- From 1991-1999, individual transport demand including road, rail and aviation grew by 18 per cent in the EU-15. The corresponding increase in transport demand by 2.1 per cent per year was higher than average annual GDP growth of 1.9 per cent.
- The current rate of increase of passenger-kilometres per capita in the EU15 is 2.1 per cent per year on average.
- The current rate of increase of the modal share of road freight transport is 4.7 per cent per year on average in the EU-15.
- Regarding freight transport, between 1991 and 1999 demand grew by almost 30 per cent in EU-15 – the average annual growth rate of 3.3 % exceeded annual GDP growth.
- Between 1990 and 1999, the share of aviation in total passenger transport increased by 50 per cent in the EU15 which corresponds to an annual average increase of 5 per cent.
- Between 1990 and 1999, the share of environmentally-friendly modes of transport in passenger transport decreased by 1.5 per cent in the EU15.
- Today the total investment in transport infrastructure represents on average 1 per cent of GDP.
- In the mid-1990s, in the EU15 road infrastructure investment dominated with 63 per cent while only 20 per cent was invested in rail.
- By 2000, about 10 per cent of the road network was affected by daily traffic jams in the EU15.
- The number of cars on European streets increased between 1990 and 2000 by 24 per cent in the EU-15, which corresponds to an annual average increase of 2.1 per cent.
- The number of cars in new Members States increased between 1990 and 2000 by 60 per cent, which corresponds to an average annual increase of 6 per cent.

Put together these thematic scenarios present a consistent picture which is close to the present as also shown by the various benchmarking indicators.

4.3.5 Where are we going? Future development of current trends

Respondents to the second wave of the FORESIGHT Delphi survey were asked to give an estimation of how the various trends reviewed in the previous section will develop in the future. In this section we report on these results.

The question format was as follows. Respondents were presented with the statement and then asked to estimate separately for the short-term (2004-2009), medium-term (2010-2019) and long-term (2020+) whether they thought the trend would persist in the same way or be higher or lower.[15]

Example.

Over the last 30 years the share of persons in the age range 60+ in the European Union has grown by over 40 per cent, representing an average 1.3 per cent annual increase. A similar trend has been observed in the New Member States since 1996.

Do you expect this trend (1.3 per cent annual increase) to be higher or lower in the next years?

Short-term (2004-2010)

Lower □ Same □ Higher □ Don't know □

Medium-term (2011-2019)

Lower □ Same □ Higher □ Don't know □

Longer-term (2020+)

Lower □ Same □ Higher □ Don't know □

Depending on the formulation of the question, the answers were recoded so as to indicate whether the respondent thought the trend would continue in the future or whether a trend-break could be expected. In the above example, for instance, respondents answering ‘same’ or ‘higher’ were classified as indicating that the trend would continue in the future, whereas respondents answering ‘lower’ were classified as indicating a possible reversal of the trend towards a trend-break.

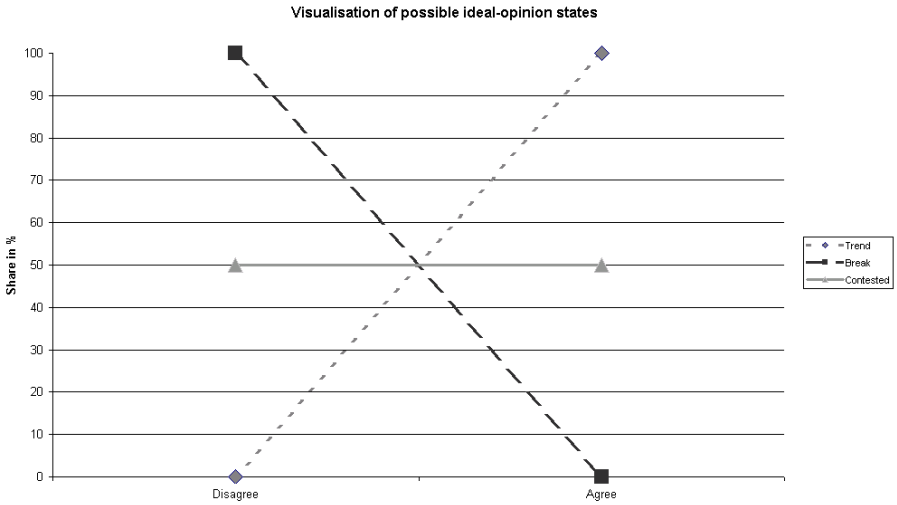

Figure 4. Visualisation of ideal-opinion states

Figure 4 visualises the ideal-opinion states. The closer the graphic representation of respondents' answers comes to the 45 degree tangent (the 'reference' line in subsequent figures), the more we may talk about the trend continuing into the future. The mirror image of this (135 degree tangent) corresponds instead to the trend-break. The horizontal line indicates that the answers are divided in such a way that we should instead speak of a contested future.

We begin by considering **demographic trends**. As we saw in the previous section past trend data speaks for an ageing society. There has been a dramatic increase of life expectancy and this has resulted in an increase of the share of persons aged 60+. In conjunction with decreasing fertility rates and stagnating net migration, population growth is also stagnating.

Till around 2020 the share of persons aged 60+ will continue to increase at the present or a higher rate (Figure 5). A reversal of this trend is also not expected after 2020 but the increasing share of respondents indicating that the rate of increase will be lower after 2020 suggests a possible slow down. As life expectancy is not expected to suddenly decrease (Figure 6), this could be the result of a slow cumulative increase of fertility rates till that time.

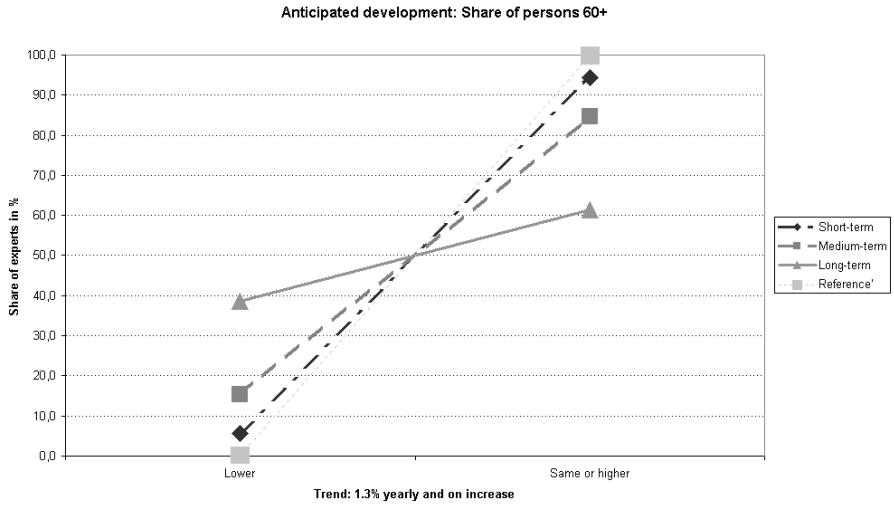

Figure 5. Anticipated development: share of persons 60+ in the population

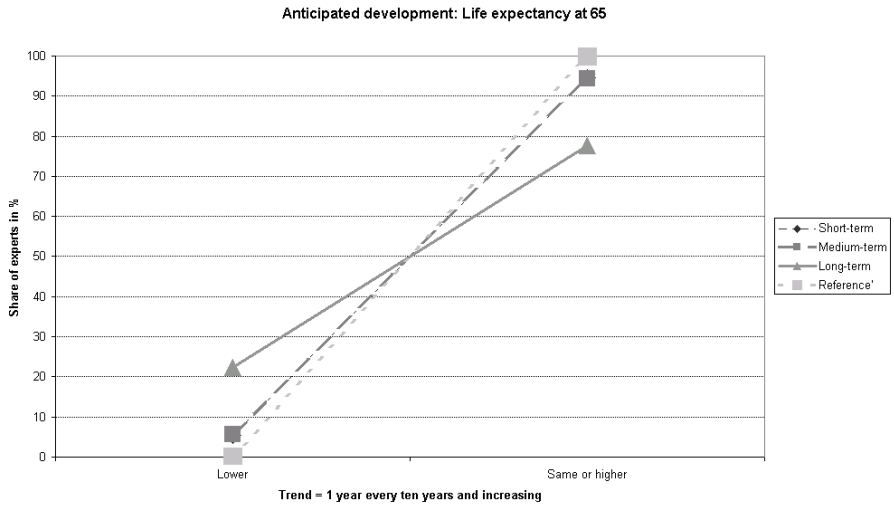

Figure 6. Anticipated development: life expectancy at 65

Comparing the expert projections on the population growth in the EU-15 (Figure 7) and in the New Member States (Figure 8) we find that the majority of experts does not expect a reversal of actual trends. However more experts think that the current negative growth trend in the New Member States might be arrested in the short- and medium-term thus bringing the rate of population growth there at levels more comparable to those in the EU-15.

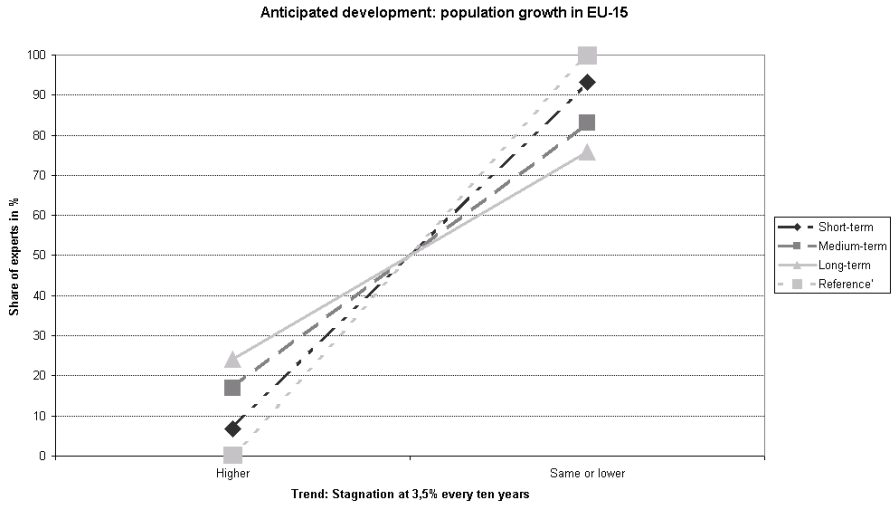

Figure 7. Anticipated development: population growth in EU-15

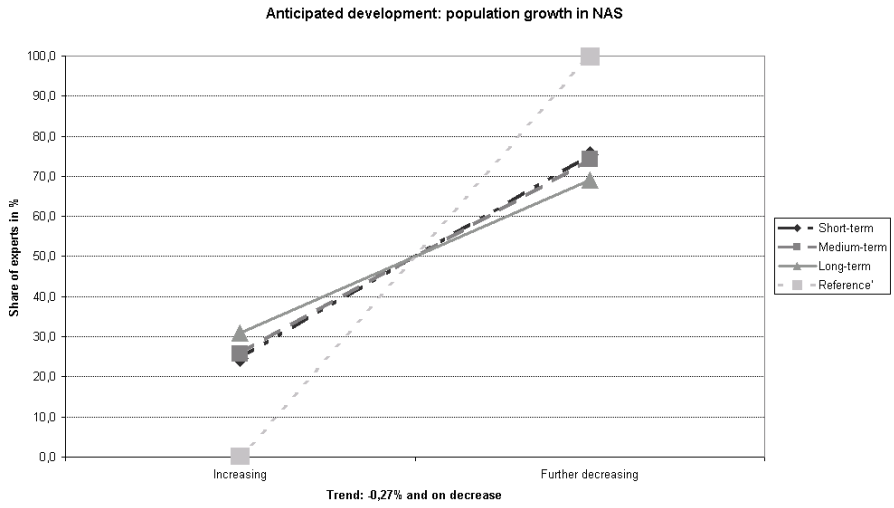

Figure 8. Anticipated development: population growth in New Member States

The projections on population growth in the New Member States are very similar to those on the development of migration (Figure 9). Again only between 20 and 30 per cent of the experts consulted expect the net migration rate to increase in the future.

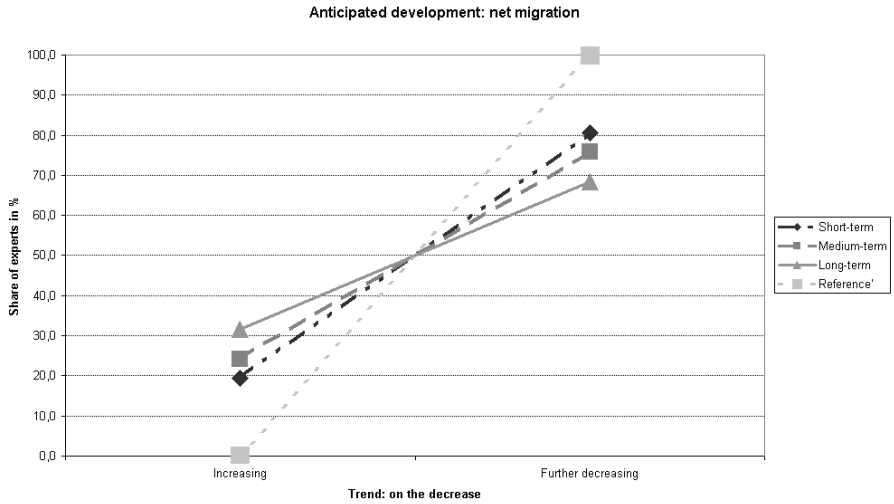

Figure 9. Anticipated development: net migration

Turning now to **attitudinal trends**, we asked the experts to assess the future development of the average power of new passenger cars (Figure 10) and of high-speed train (HST) lines traffic (Figure 11) as an indication of preference for time and speed.

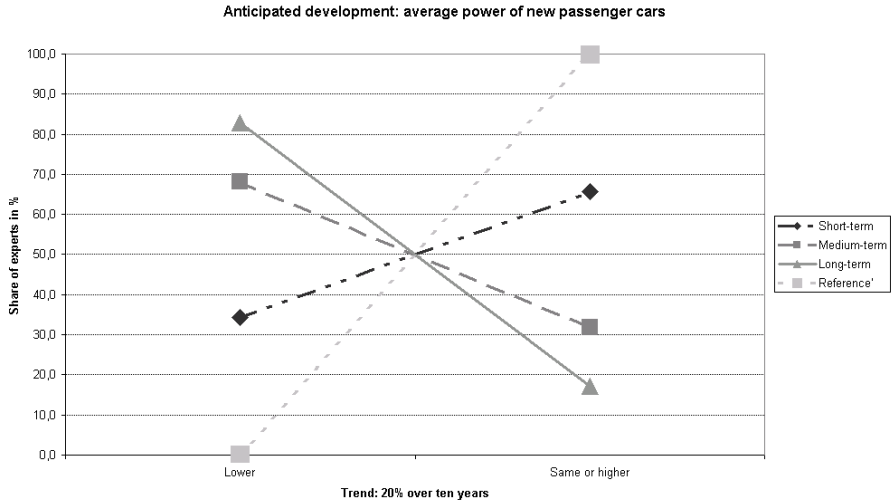

Figure 10. Anticipated development: average power of new passenger cars

Experts expect in their overwhelming majority a trend break with regard to the average power of new passenger cars. This trend break is expected to occur in the medium-term, i.e. after 2010. Consistent with this, the majority of the experts expect that the contemporary trend towards the increase of high-speed train traffic will continue even if at a slower rate in the long-term.

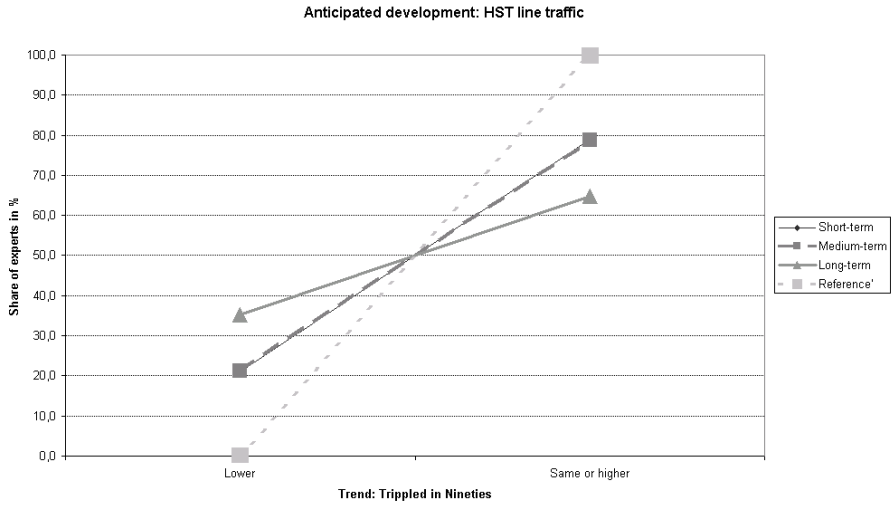

Figure 11. Anticipated development: high-speed train line traffic

These assessments appear to suggest that we can expect a shift to more environmentally-friendly modes of transport despite the continuing preference for saving time and for speed. This has undoubtedly to do with the persistent positive attitudes towards the environment (Figure 12) but also the greening of the car industry.

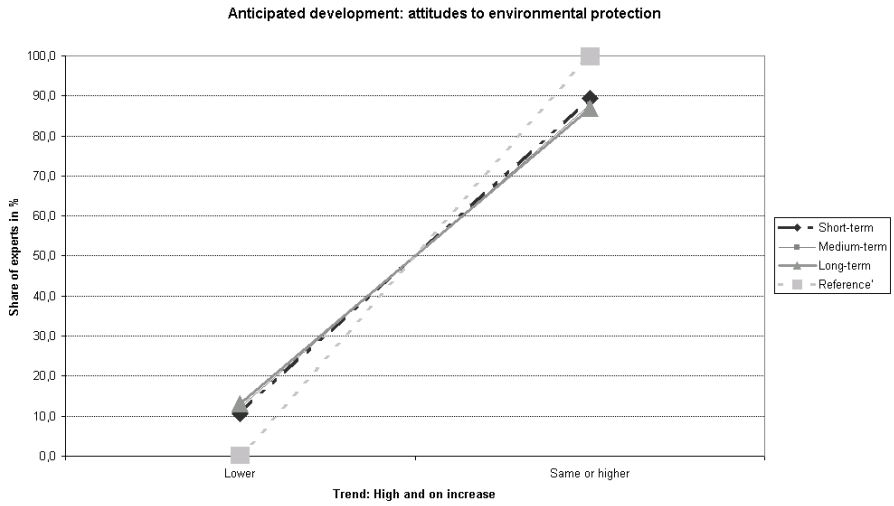

Figure 12. Anticipated development: attitudes to environmental protection

Moving on to **social developments** we find that the contemporary trends towards the flexibilisation of work and the labour market are expected to continue. Part-time and telework (Figures 13 and 14 respectively) will both continue to gain in importance at the same time that the employment rates stagnate (Figure 15).

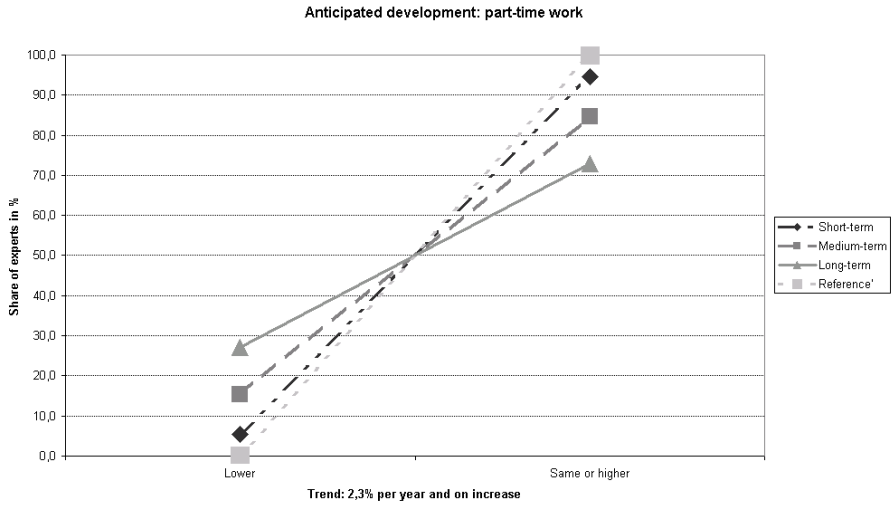

Figure 13. Anticipated development: part-time work

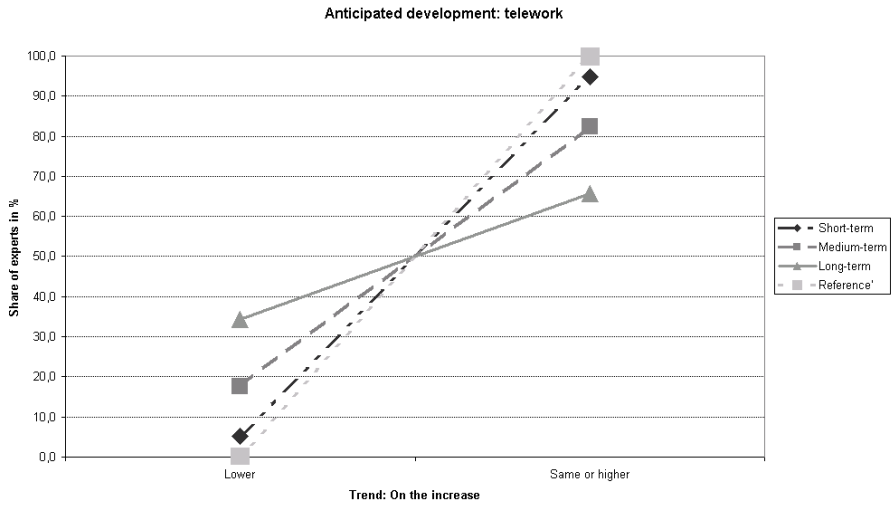

Figure 14. Anticipated development: telework

Only around 30 and 20 per cent of the experts expect labour market demand to increase in the medium- and long-term respectively. This is the case despite expectations for economic growth both in the EU-15 and in the New Member States (Figures 18 and 19 respectively). In other words the uncoupling of labour market demand from economic growth which we are already witnessing will continue into the future.

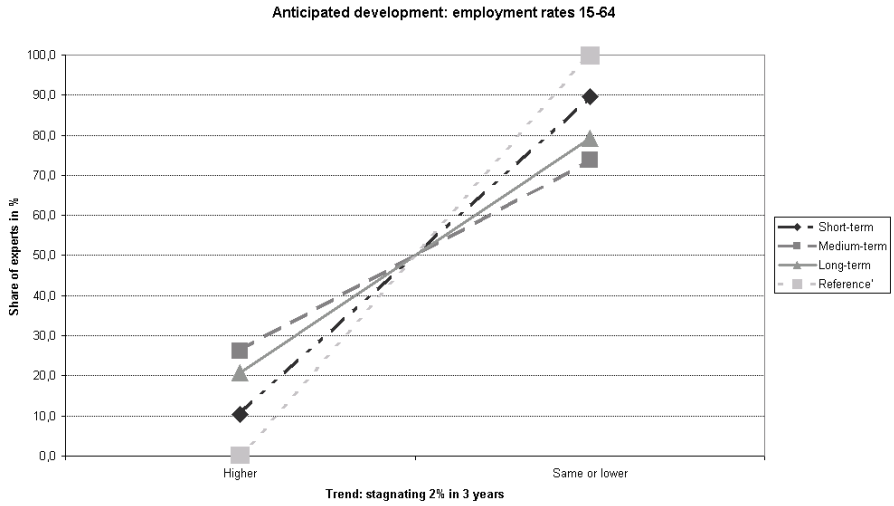

Figure 15. Anticipated development: employment rates 15-64

The flexibilisation of the labour market will be accompanied by the intensification of **knowledge- and technology-related sectors**. In their overwhelming majority, the experts consulted anticipate a further increase of the share of persons employed in the high-tech industry and of high-tech patents (Figures 16 and 17 respectively).

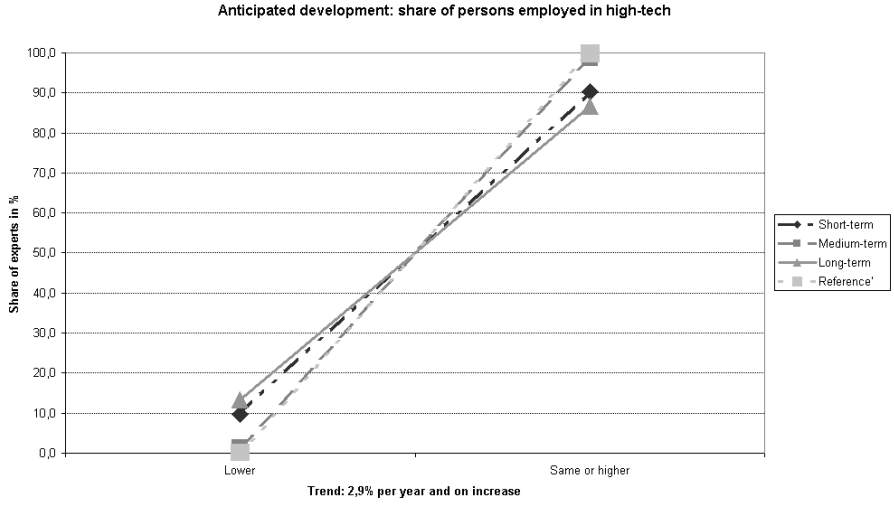

Figure 16. Anticipated development: share of persons employed in high-tech

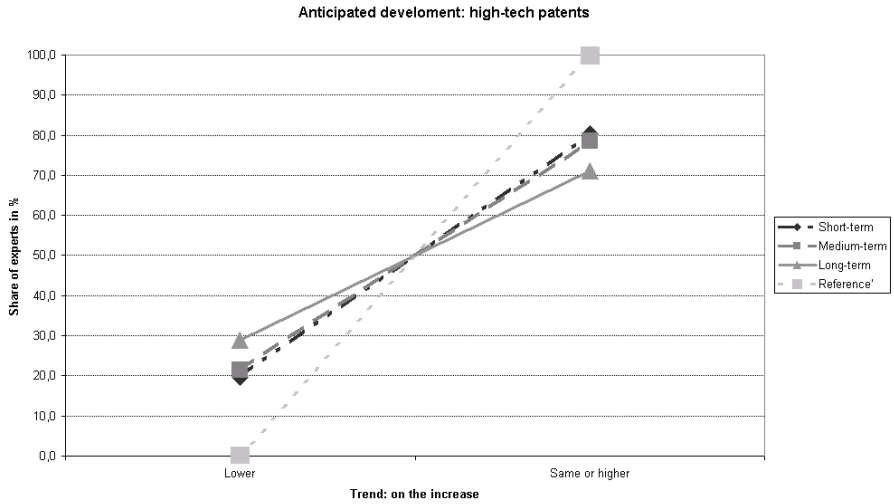

Figure 17. Anticipated development: high-tech patents

Around 60 per cent expect **the economy** in the EU-15 to continue to grow at around the current average rate of 2.5% per year in the short-term; 80 per cent are of the same opinion regarding the medium-term and 70 per cent for the long-term. In other words, the actual recession is considered by the majority as a short-term phenomenon.

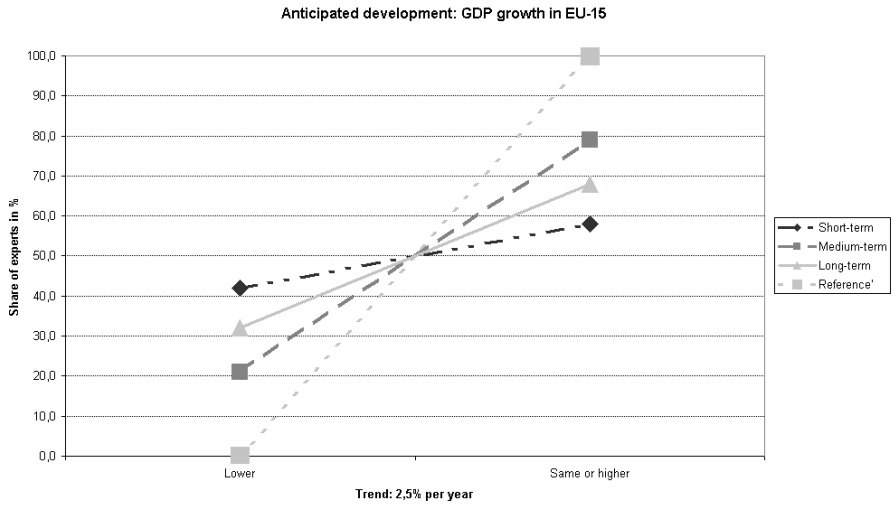

Figure 18. Anticipated development: GDP growth in EU-15

Similar are the assessments for the New Member States whereby the benchmark there is much higher at 4 per cent. Opinions nevertheless diverge on whether this rather high rate of economic growth can be kept up in the long-term, i.e. after 2020.

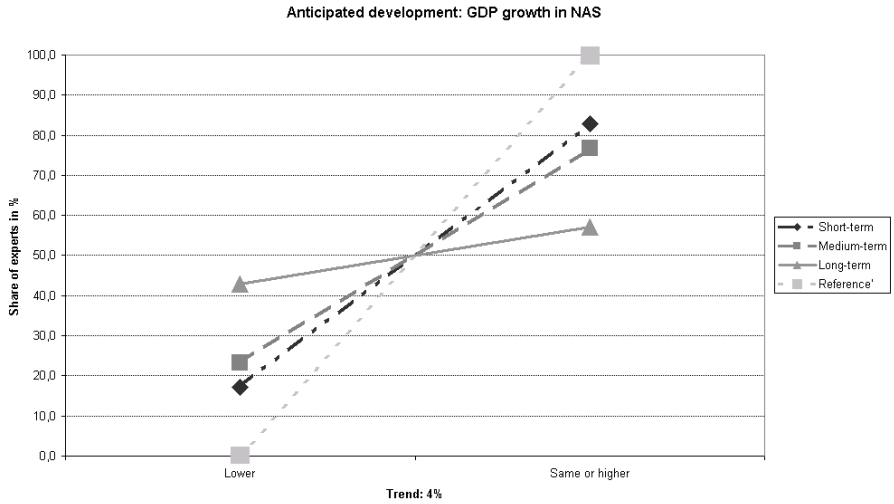

Figure 19. Anticipated development: GDP growth in New Member States

Economic growth, especially in the New Member States, is associated by many of the experts as closely linked to the project of European integration and the alignment of policies to those of the EU-15. This **process of policy coordination or even harmonisation**, which we have been witnessing since the beginning of the 1990s with the inauguration of the Maastricht Treaty, is expected to continue in the future and especially in the short-term with European enlargement. Only 20 per cent of the experts consulted think this trend will be reversed and if so then in the long-term.

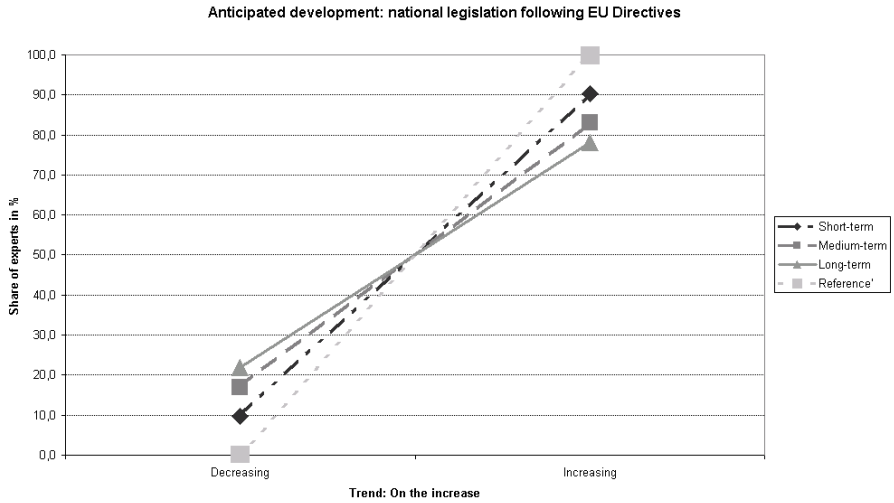

Figure 20. Anticipated development: national legislation following EU directives

Economic growth is becoming uncoupled from labour market demand. Is a similar process of decoupling taking place with reference to **energy consumption and environmental degradation**?

Figure 21 displays the experts' judgements regarding final energy consumption, figure 22 for transport energy consumption.

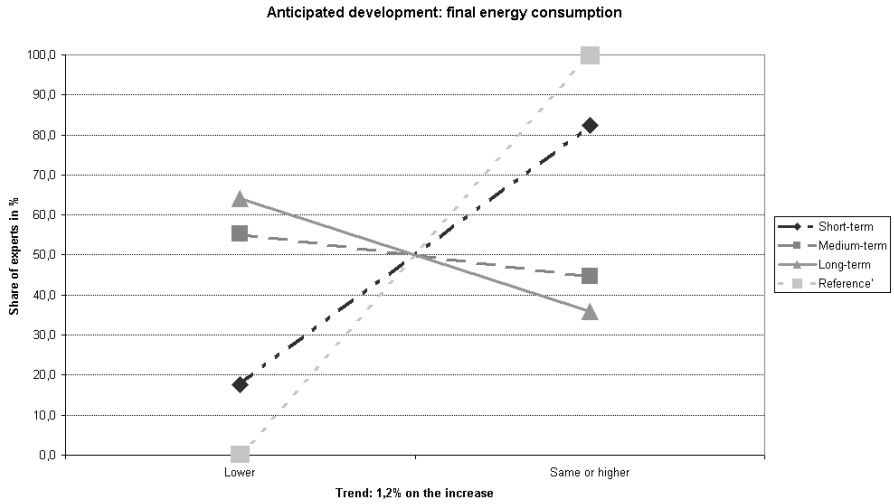

Figure 21. Anticipated development: final energy consumption

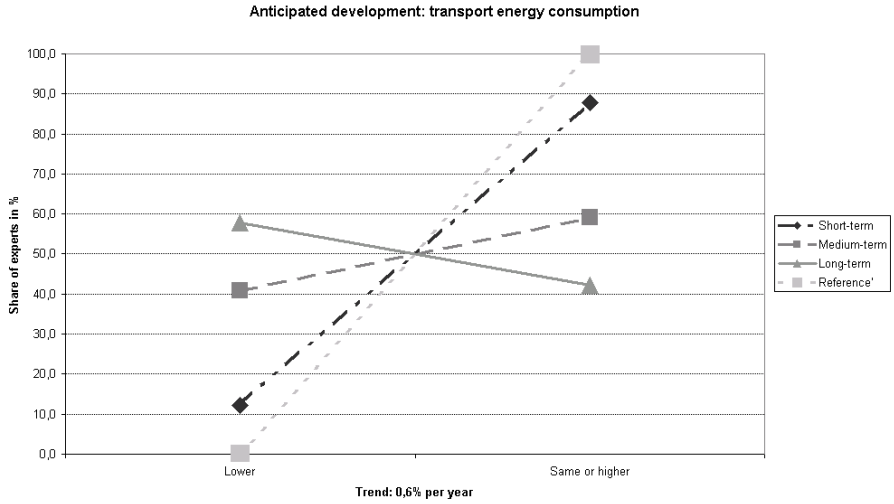

Figure 22. Anticipated development: transport energy consumption

No significant change in this regard is expected in the short-term. Only a small minority of experts (17 and 12 per cent regarding final energy and transport energy consumption respectively) are of the opinion that there will be a slow-down in this respect between now and 2010. But opinions begin to diverge quite

significantly in the medium-term and this allows us to talk about a possible trend-break in the long-term. It is furthermore expected that this trend-break will first occur at the generic level prior to beginning to also impact in the transport field.

There are several reasons speaking in favour of this long-term trend break. One is the share of renewable energies in energy production. The overwhelming majority of the experts consulted (over 90 per cent) think this share will continue to increase at the current or higher rate and in a stable manner over the years to come (Figure 23).

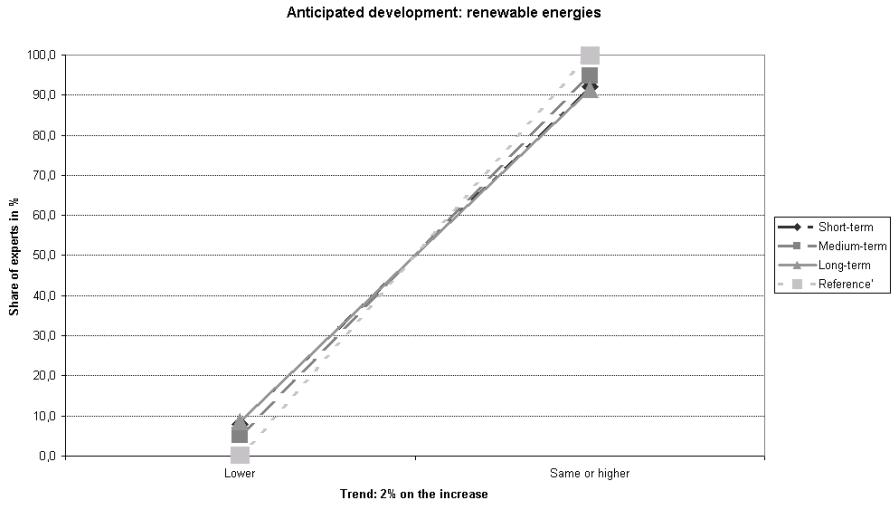

Figure 23. Anticipated development: share of renewable energies

Another reason for this trend-break is the price of fuel. Both the prices for unleaded petrol and for diesel are expected to continue to increase and do so steadily over the next years (Figures 24 and 25 respectively). It should here be recalled that in the past prices for unleaded petrol had tended to fluctuate while prices for diesel have tended to be low, not least with the argument that diesel is environmentally-friendly, a line of argumentation that has now been definitely proven to be wrong.

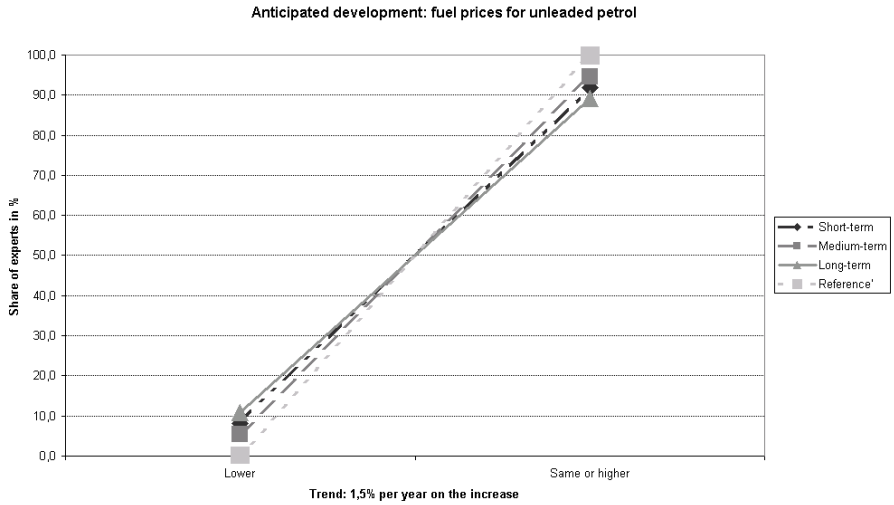

Figure 24. Anticipated development: fuel prices for unleaded petrol

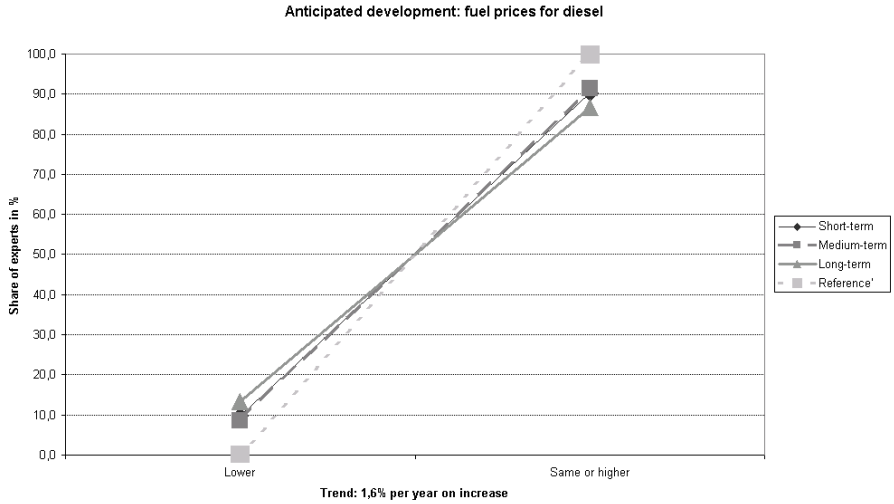

Figure 25. Anticipated development: fuel prices for diesel

Consistent with the above are the assessments about the share of environmental degradation to be attributed to transport. A trend-break with regard to the share of transport in CO_2 emissions (figure 26) is anticipated after 2020 while NOx emissions (figure 27) will continue to decrease as in the recent past. These assessments hold true for both the EU-15 and the New Members States.

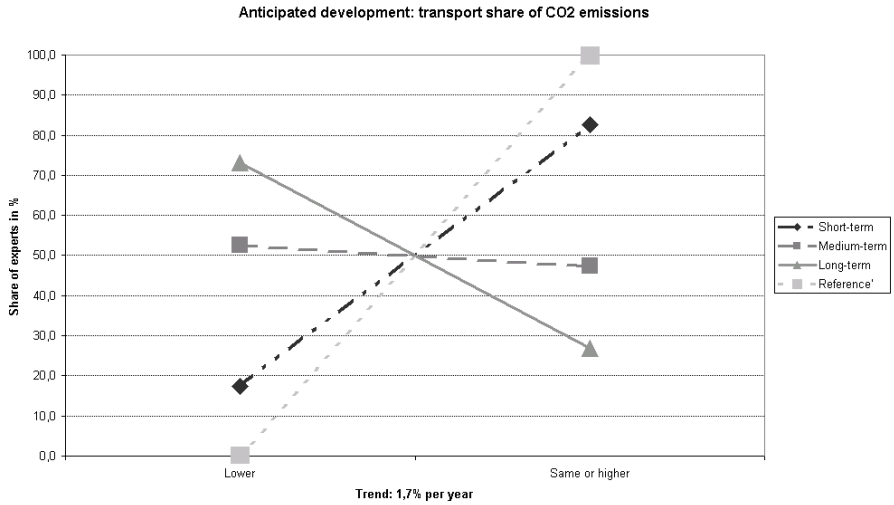

Figure 26. Anticipated development: transport share of CO2 emissions

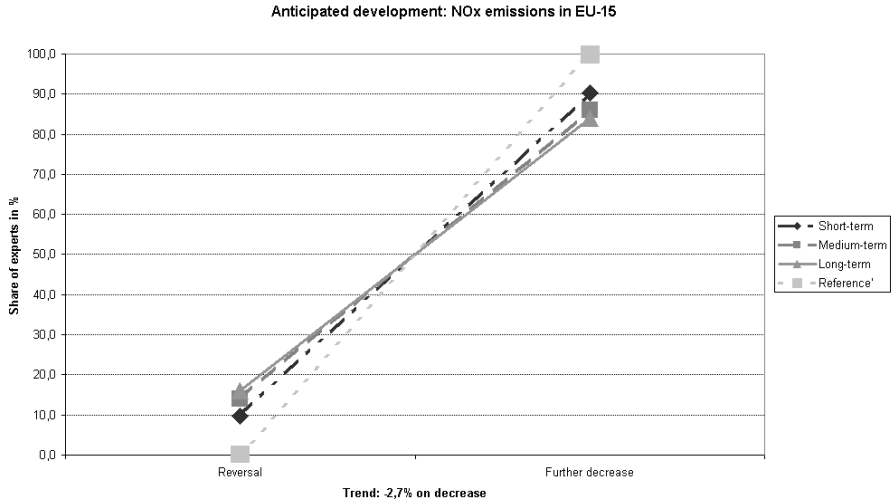

Figure 27. Anticipated development: NOx emissions

How will the above changes be affecting **transport**?

Let us begin with transport demand. This currently grows at rates similar or higher than the rates of economic growth. Figures 28 and 29 display the experts' assessment of the development of individual and freight transport demand respectively. In the short-term no major change is expected. In the medium and long-term a slow down is anticipated: around 30 per cent are of this opinion regarding the medium-term, the respective figure for the long-term is 60 per cent. Still it is important to note that a slow-down is not necessarily equivalent to a reversal.

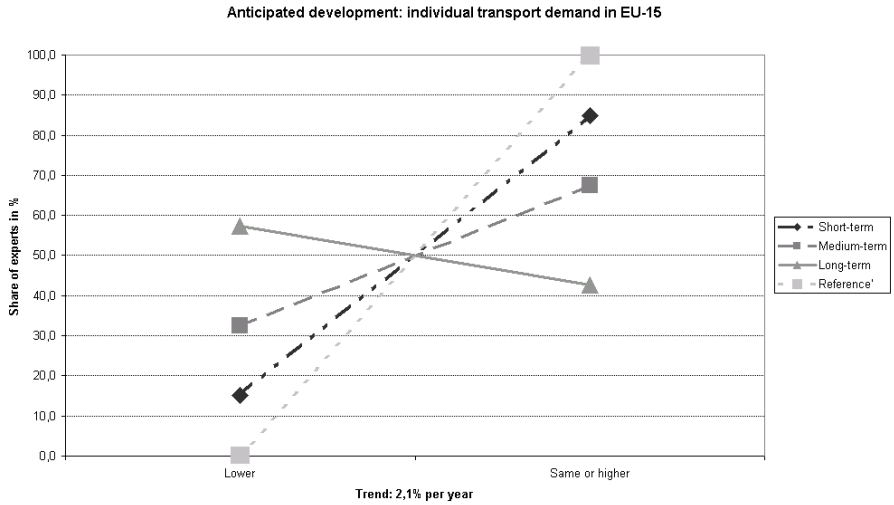

Figure 28. Anticipated development: individual transport demand

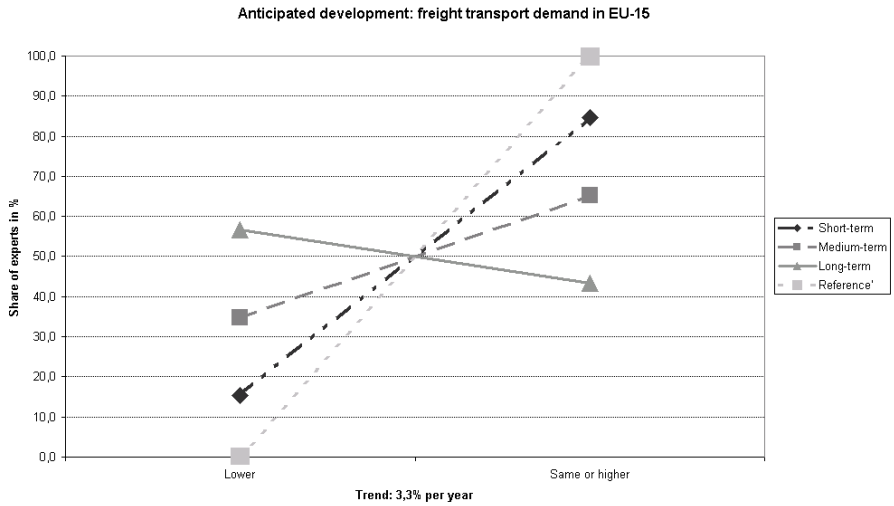

Figure 29. Anticipated development: freight transport demand

The anticipated positive growth of passenger transport demand will not necessarily be accompanied by a further increase in the rate of growth of individual motorised transport (figure 30) or aviation (figure 32).

The majority of the respondents (93 per cent for the short-term and 61 per cent for the medium-term) is of the opinion that individual motorised transport will remain stable at a high level. Opinions are completely divided insofar as the long-term future is concerned: every second respondent thinks individual motorised transport will continue to enjoy high acceptance also after 2020, the other half believes in a trend-break. The assessments regarding congestion (figure 31) are more pessimistic: less than 30 per cent expect less congestion in the future, even after 2020.

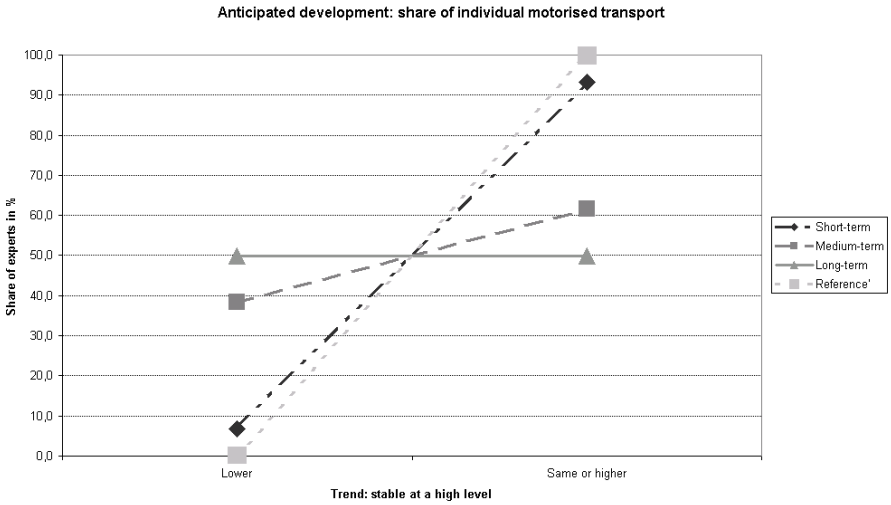

Figure 30. Anticipated development: individual motorized transport

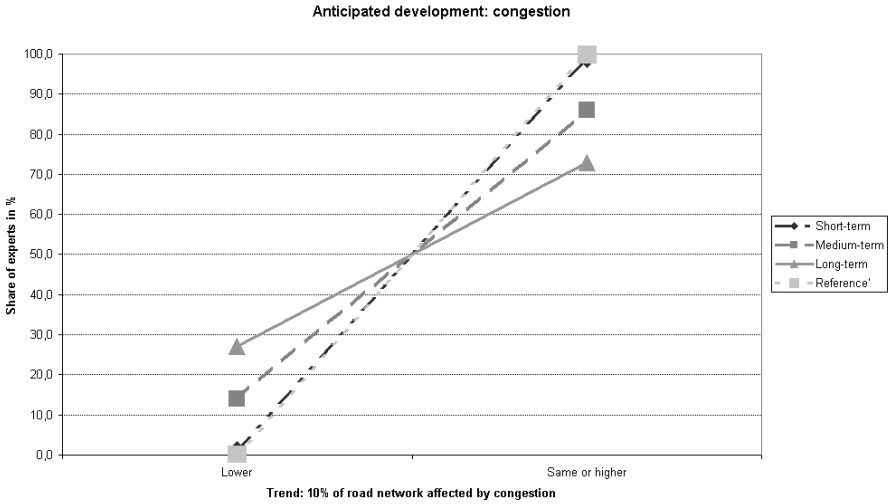

Figure 31. Anticipated development: congestion

Similar are the assessments regarding the share of aviation. Only slightly more respondents (55 per cent) are of the opinion that aviation might begin to lose in significance in the long-term.

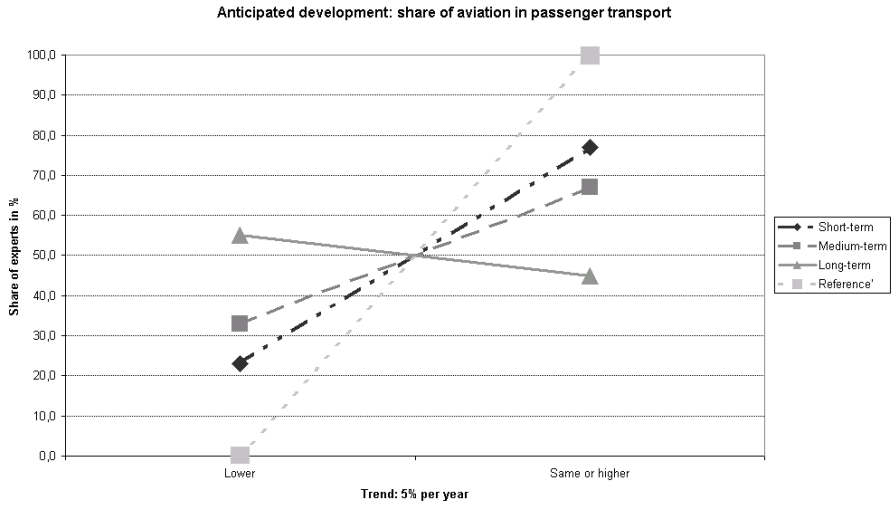

Figure 32. Anticipated development: share of aviation in passenger transport

Not surprisingly considering the above, the improvement of the accessibility of public transport (Figure 33) is judged less optimistically. Improvements in this connection are only expected in the long-term and even then the majority (55 per cent) is of the opinion that the situation of public transport will not dramatically improve.

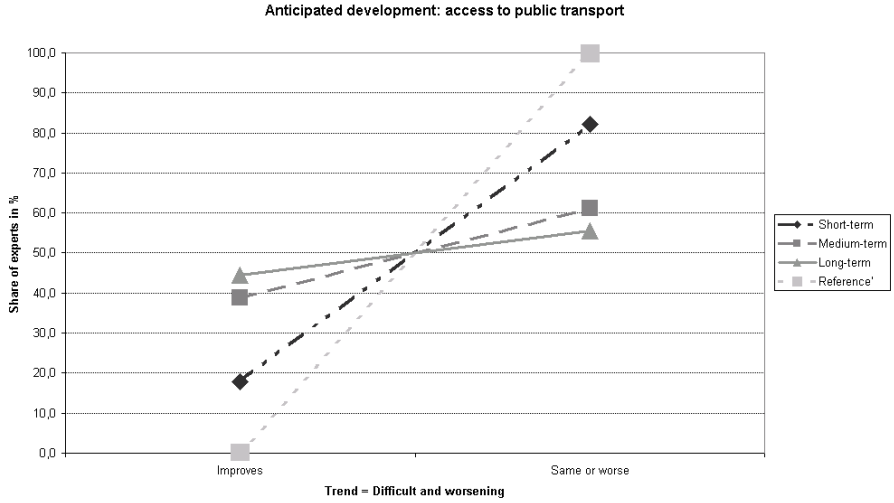

Figure 33. Anticipated development: access to public transport

Experts assess freight transport somewhat differently. Freight transport demand is expected to increase but in the long-term possibly at a lower rate than at present. Unlike with passenger transport, a modal shift from road to rail is considered possible after 2020 by the clear majority (70 per cent) of the respondents (Figure 34).

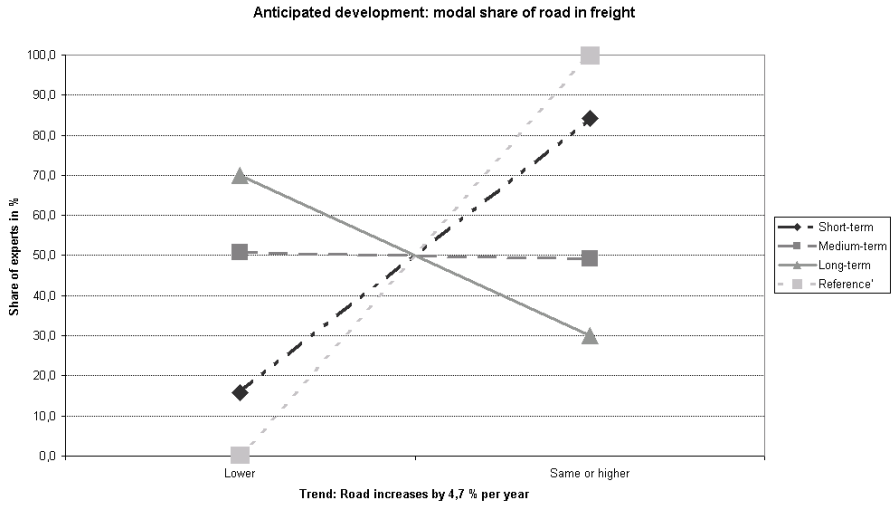

Figure 34. Anticipated development: road share in freight transport

This modal shift will come about not least through more investment into railways. However, once again, this is not expected to happen in the near future, possibly because of enlargement placing strong demands on the expansion and upgrading of the motorway network in the New Member States.

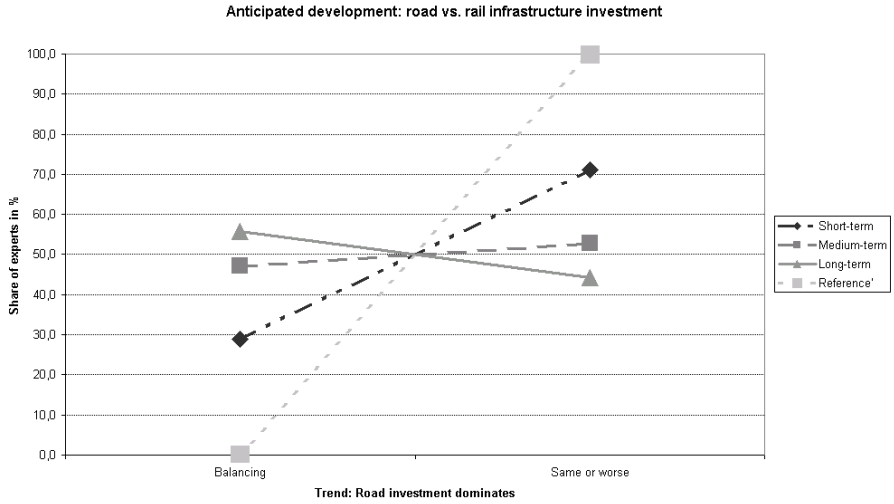

Figure 35. Anticipated development: road vs. rail infrastructure investment

One other reason for the delay in materialising a balancing of modes as required by the White Paper on European Transport Policy has to do with the fact that investment into transport infrastructure has tended to stagnate during the last years. 70 per cent of the respondents expect investment into transport infrastructure to increase, albeit only in the medium-term, i.e. after 2010 (figure 36).

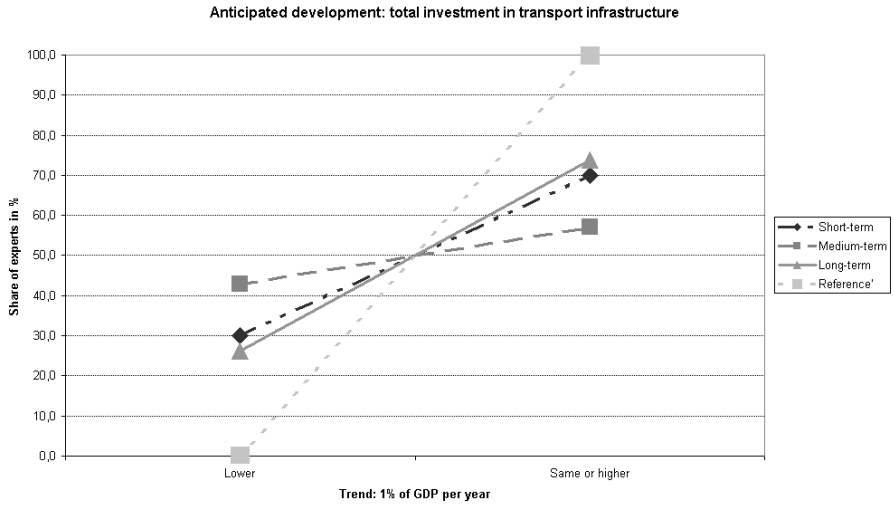

Figure 36. Anticipated development: investment in transport infrastructure

The anticipated developments of contemporary trends presented above and based on the aggregate analysis of the responses to the FORESIGHT for TRANSPORT Delphi survey could be said to represent an assessment of the current situation and actual policies. The general view would appear to be that we can indeed observe a shift towards sustainable mobility. However given the slow pace of implementation of relevant policies (with regard to fuel prices, investment strategy etc.) and the likewise slow diffusion of innovations (for instance with regard to renewable energy) positive impacts in terms of environmental degradation or the re-balancing of modes is not expected to begin to happen prior to 2010.

As a result, opinions regarding the White Paper projections on passenger and rail freight diverge: around half of the respondents agree with the statement that passenger rail and freight rail will be increasing at an average yearly rate of 2.7 per cent, the other half disagree. This is however also not surprising. The White Paper itself does not argue that such growth rates are possible at no cost or with no new policy initiative. What such policy initiatives may look like for passenger and freight transport respectively was discussed in the previous section on transport impact pathways. In the next section we shift our attention to alternative scenarios for the future and, in that, to the pre-conditions within external non-transport policy domains that would facilitate or obstruct the implementation of specific transport policy initiatives aiming at achieving sustainable mobility.

4.3.6 Alternative scenarios

Just as it was possible to specify the reference scenario with reference to the most likely thematic scenarios corresponding to specific policy domains, it is possible to define a future ideal-state with reference to those thematic scenarios assessed as most desirable. Such an ideal-state scenario follows the visionary model of scenario-writing (see section 4.2.5). Following the precautionary model we may also describe a negative state of affairs which ought to be avoided. A number of alternative scenario pathways can then be characterised with reference to the most likely, most desirable and most negative state of affairs.

4.3.6.1 The visionary model: sustainable European ecological identity

The future which represents the most desirable state of affairs is that which capitalises on the positive elements of the present and completely overcomes its negative aspects. This we have called the 'Sustainable European Ecological Identity' future scenario.

Table 2. Ideal (most desirable) scenarios	
Demography	New age balance
Attitudes	Pluralism and tolerance
Social developments	Nordic welfare system, decrease of inequalities
Institutional arrangements	Cooperation frameworks (not excluding federalism)
Technology	Technological breakthrough
Political	New forms of plural identities and active citizenship
Environment	Strong sustainability with emphasis on ecology
Economy	Ecological time economy
Transport	Ecological transport

Source: Delphi survey, Waves 1 & 2

Demographically we observe a reversal of the declining fertility trend and a loosening of migration controls. As a result there is a counter-balance to the ageing population and this leads to a more balanced distribution of age cohorts within and across societies.

In terms of attitudes and the Zeitgeist we find a cosmopolitan (open) attitude combined with tolerance towards difference supporting pluralism and liberalism. Individual autonomy is valued, albeit balanced with solidarity (towards others and the environment). Technology is valued as a means to an end.

Inequalities decrease due to a strong commitment to the welfare system accompanied with an emphasis on activation and labour market policies. In terms of structural policies there is an emphasis on regional development and cohesion.

At the institutional front an emphasis is placed on promoting cooperation and policy alignment albeit within a flexible framework that respects subsidiarity, on the one hand, and promotes solidarity among countries, on the other hand. This is not contradictory with federalism but it also does not presuppose it.

This is supported by the strengthening of a European identity which co-exists peacefully with other identities (national, cultural, religious) and is supportive of active citizenship. Elite closure in politics is thus overcome.

New technologies bring about a revolution in the way we live and produce, and there are also fundamental positive impacts on mobility and transport.

This future is driven by a paradigm shift in values and the perception of life quality towards environmental sustainability. This leads to massive CO_2 reduction through less materialism, less transport (both short- and long-distance), as well as different urban development principles. Moreover sustainable development is understood with reference to time, that is, the time-scale of depletion and degradation of resources has to be proportional to the timescale of regeneration.

Because environmental quality and economic growth are not compatible, new measures of progress are applied. Ecological concerns and objectives determine economic goals and strategies rather than the other way around. This corresponds to a time economy that seeks time quality, synchronisation and punctuality.

As a result, a significant decrease of transport demand can be observed and both for international and national transport as well as for passenger and freight transport, with technology substituting for mobility (through e-commerce and e-work). There is an increase in the demand for short-distance local mobility, both for work and for leisure. This is, however, primarily met through non-motorised transport. Non-motorised transport as well as shared modes of transport are explicitly supported through policy, i.e. tax-breaks, company transport plans, as well as RTD and ICT. Social inclusion as well as punctuality and reliability rather than speed are high on the transport policy agenda.

The above conditions were assessed as ideal by the respondents to the FORESIGHT Delphi survey but they were also judged as unlikely to materialise – individually and, especially, in their totality.[16] The negative assessment of this future in terms of its probability of occurrence does not only reflect pessimism. A certain pragmatism seems to be here at work in view of the real difficulties involved in optimising ecological, social and economic needs and doing this in an almost conflict-free manner. This ideal state of affairs appears to assume that trade-offs are neutralised or not relevant in terms of the distribution of resources. In practice this is very difficult to realise, at least within the time framework considered by the project.

Nevertheless this utopian – currently – vision is useful as a reminder of what societal transformations could or should be aiming at and, therefore, as a benchmark against which to judge contemporary developments and alternative pathways. One other such important benchmark is the negative future state of affairs.

4.3.6.2 The precautionary model: governance failure

The negative future state of affairs can be described with reference to those developments which are most feared. This state of affairs we have named 'Governance Failure'.

Table 3. Negative future state (most feared)	
Demography	Ageing trends persist and aggravated
Attitudes	Polarisation and friction
Social developments	Laissez-faire social model, inequalities increase
Institutional arrangements	European centralised state, decline of democracy
Technology	Technological breakdown
Political	Political polarisation
Environment	Environmental degradation
Economy	Recession
Transport	Aggravation of contemporary transport problems

Source: Delphi survey, Waves 1 & 2

In some respects this negative future state of affairs is similar to the reference scenario: we observe a continuation and aggravation of contemporary ageing trends, social inequalities increase and transport problems in terms of congestion and environmental degradation persist and are heightened. This is caused by the prolongation of economic recession in conjunction with technological breakdown.

The reason for calling this negative future state of affairs 'governance failure' has to do with the failure of existing institutional arrangements to deal with negative developments. Indeed the fact that decision-making is centralised and follows a hierarchical technocracy logic paying little attention to sub-national levels of government makes it incapable to address social problems. As a result we observe a marked polarisation within societies across the urban / rural dimension and cultural / religious traditions. As difference is not tolerated there is friction and conflict. Mistrust in political institutions increases and this leads to the strengthening of right-wing extremism. Enlargement and, more generally, the project of European integration as a project of peace is arrested and ultimately breaks down.

4.3.6.3 Plausible positive futures

There are three positive futures which can be envisaged as less utopian than 'Sustainable European Ecological Identity' but better in terms of outcome than the reference scenario.

These are the scenarios 'Federal State Europe', 'Local Governance' and 'A New European Elite'.[17]

Federal State Europe
The emergence of a new sense of public interest at the interface between individual autonomy and a new social consciousness and the consolidation of European identity lead to the consolidation of federalist structures at European Union level and the adoption of a strong social agenda against inequality and high economic growth. This gives momentum to environmental policies aiming to reduce the negative external effects of transport through economic and technological instruments. Transport demand continues to be high with regard to international trade (in line with high economic growth and economic integration) but short-distance motorised transport goes down mitigating the negative effects of transport. Overall we observe an increase both of the rail and short-sea shipping share in transport patterns.

Local Governance
The emergence of a new sense of public interest at the interface between individual autonomy and a new social consciousness together with the consolidation of European identity lead to a re-assertion of local governance and full decentralisation. A Europe of the regions emerges. Economic production and development as well as transport are re-organised according to ecological principles supporting strong sustainability – in general and with regard to transport – and new forms of social organisation with less work, more leisure and a strong voluntary sector emerge. This is in part possible because of strong technological innovations

A New European Elite
Under this scenario external pressures arising, for instance, from environmental or technological failures lead to a change in the thinking of the elite and, at the same time, a generational change. Economic forms of production are ecologically reformed and institutional arrangements are reformed towards technological innovation, sustainability and federal structures.

The desirability of the first two of the above scenarios is not as high as that of the visionary model but comes close: 60 per cent of the respondents to the first wave of the FORESIGHT Delphi survey gave high rankings of desirability to 'Federal State Europe' as compared to 55 per cent for 'Local Governance' and 79 per cent for 'Sustainable European Ecological Identity'. Their probabilities for realisation were estimated in reverse by the respondents to the second wave of the Delphi survey as 0.54, 0.40 and 0.22 respectively.

The third scenario 'A New European Elite' was judged as both less desirable and less likely: just over 20 per cent of the respondents to the first wave of the Delphi survey gave this scenario high rankings in terms of desirability and likelihood. This is probably because this scenario presumes that a 'change of mind' in politics and policy only comes about following major environmental disasters or technological failures.

More interesting for our purposes is to highlight how the above positive futures which are considered more plausible than the visionary future 'Sustainable European Ecological Identity' differ from the reference scenario which describes the present. This gives us an insight into what would need to be changed to ensure that the positive pathways already entailed in the present turn out well – either eventually or at a faster pace.

We concentrate on 'Federal State Europe' and 'Local Governance'.

'Federal State Europe' is similar to the reference scenario with regard to demographic trends (ageing), technology (incremental innovations), environmental policy (following the 'weak sustainability discourse and emphasising economic and technological measures) and the economy (growth or stabilisation at a moderate positive level). It differs from the reference scenario in terms of institutional arrangements, politics, attitudes and social policy. Analytically it anticipates that the consolidation of a state political system at European level following federalist provisions makes it possible to establish a multilevel governance system which performs well in terms of policy coordination whilst also leaving room to the national and sub-national levels to define and implement policy following subsidiarity. The reader will recall from the transport impact pathways that policy coordination on a broad scale was judged of particular relevance for effecting change with regard to the better management of long-distance freight transport while local measures were identified as especially important in terms of individual mobility management (see also chapter 8). This successful multilevel governance framework also supports the emergence of active citizenship which, in turn, provides the basis for moving towards a new European identity which is open to the peaceful mediation of interests or conflicts – whether within policy or in the socio-cultural sphere. That this is possible is also fundamentally due to the better coordination of economic and social objectives through the formulation of a strong social agenda that seeks the overcoming of inequalities. Neither environmental nor transport problems disappear entirely, but improvements are notable.

Under 'local governance' environmental sustainability and social cohesion are given priority over economic goals and this impacts also positively on transport with regard to congestion and environmental externalities. In that, this scenario is more similar to the visionary model of 'Sustainable European Ecological Identity' and both attribute a major role to technological innovation. However unlike the visionary model, 'local governance' does not expect such a re-orientation to be possible within a trans-national institutional framework, hence also the name of this future emphasising both decentralisation and regional identities. This scenario is not as optimistic regarding outcomes as the visionary model but it puts forward the claim that a new economic paradigm following ecological principles is only possible within an institutional framework that is largely oriented to the local level, also in terms of production, hence demand

and supply, as well as mobility. This also presupposes a strong voluntary sector, especially within social policy.

4.3.6.4 Plausible negative futures

There are two negative futures which are less horrific than the negative state of affairs described under 'governance failure'. These are the scenarios 'Technocratic Federal Europe' and 'Technocratic European Nation-States'.

Technocratic Federal Europe
Under this scenario we observe the emergence of a federal Europe in the context of elite closure and the weakening of representative democracy at national and European levels. High economic growth supports welfare maximisation and the successful fighting of inequality. Less attention is, however, granted to the negative externalities of transport. Incremental improvements can be observed due to economic measures and technological developments but the problem of environmental degradation as such is not resolved.

Technocratic European Nation-States
Elite closure leads to the strengthening of the nation-state rather than the formation of a federal state. Economic growth stabilises at a low level and social inequality and unemployment increase. Technological development is incremental. Economic measures are differentially applied. Transport impacts remain negative and are not dealt with.

None of the above two future scenarios is judged desirable. Yet both are thought as not unlikely to materialise. Indeed 'Technocratic Federal Europe' was given high rankings in terms of likelihood by 52 per cent of the respondents to the first wave of the Delphi survey. The respective figure for 'Technocratic European Nation-States' was 38 per cent.

Both scenarios anticipate the strengthening of technocracy in policy-making and judge this negatively. In the former case technocracy dominates at the European level within a federal framework, in the latter case there is a re-assertion of the nation-state. The avoidance of governance implosion is largely due to continuing economic growth which makes it possible to maximise welfare and – under 'Technocratic Federal Europe' – to contain inequality. Environmental sustainability and sustainable mobility do not receive particular attention. At best only incremental improvements can be observed and these are largely due to the gradual playing out of technological achievements and economic measures of former times. The over-reliance of both of these scenarios on economic development to contain conflicting interests is also what makes them highly unstable and tending towards a far more negative state of affairs.

4.3.7 Concluding assessment

In this section (§ 4.3) we presented the main results of the FORESIGHT for TRANSPORT study. We began by discussing key developments in what we have called 'external' policy domains to characterise those domains that are not under the direct influence of transport policy but which can be said to impact on both mobility and the transport system in variable ways (§ 4.3.1). We then proceeded to present the key indicators that need to be monitored for charting developments in these external policy fields (§ 4.3.2). The next section (§ 4.3.3) on transport impact pathways depicted how specific elements of external policy domains impact on transport and mobility directly or indirectly by mediating other effects. Section § 4.3.4 described the current situation with reference to past trends. In section § 4.3.5 short-, medium- and long-term projections of several benchmarking indicators were presented. Finally section § 4.3.6 outlined alternative scenarios.

Contemporary transport policy is in many respects on the right track. Transport demand may still be rising at a rate higher than that of economic growth and the share transport contributes to environmental degradation still persists. Nevertheless the present also entails a number of positive developments like the greening of the car industry, the identification of renewable energies as a potential market and the increased awareness of the importance of economic and taxation measures for effecting shifts towards sustainability. Positive effects resulting from these developments are anticipated in the medium- and long-term. The problem is primarily one of implementation and timing. At the present rate of change and assuming there is no major stumbling block positive changes will begin to be felt mostly after 2020. This might be too long of a time framework.

At the same time the present also entails destructive elements. The present situation is not such that we can lay back and rest assured that inevitably it will all turn out well. The slow down of the economy in conjunction with increasing social inequalities and the real loss of power of social and political institutions to effect change in the short-term contribute to the perceived instability and insecurity. These dangers are not inherent to transport but they affect transport as well. Governance failure is not imminent but the tendency to substitute technocracy for governance is a real problem currently faced at both national and European levels.

Contextual conditions facilitating progress along the paths already established include a multilevel governance framework within which policy coordination and cooperation can be designed *and* implemented as well as a social policy agenda that assists in the integration of economic and social objectives in the face of the challenges of the knowledge society that brings about an uncoupling of economic growth from labour market demand. A better linking of economic

and social objectives will also make it easier to integrate environmental sustainability concerns into sectoral policy.

The transport impact pathways suggest strategies for policy for individual and freight transport. These are re-visited and elaborated in chapter 8. Here suffice to note that the comparative assessment of the transport impact pathways highlighted the need for different policy strategies for passenger and freight transport respectively, not least because the two segments are differentially influenced by external non-transport policy domains. Individual mobility and hence passenger transport is much more open to external influences from areas such as socio-demographic developments and the labour market than freight transport. The latter can be more directly influenced by transport policy proper extended to include environmental concerns next to economic considerations. The challenge here is implementing relevant policies at a large scale – ultimately a challenge of multilevel governance. Individual mobility management, on the other hand, has to be better coordinated with labour market, housing and urban planning policies, yet be anchored at the local level.

5 List of deliverables

The following table reports on the project deliverables and their status at the end of the project's contractual period.

FINAL REPORTING PERIOD						
Contract No. ***GMA2/2000/32057 SI2.322291***						
Acronym: FORESIGHT for TRANSPORT						
SCHEDULE of DELIVERABLES						
Type / Description	Available	Nature	WP	Lead	Delivery (planned)	Delivery (actual or revised)
State-of-art Inception Report (D1)	P	RE	WP1	ICCR	04/2002	04/2002[a]
Consultation Document Enlargement & Transport (D2)	P	RE	WP1	NESTEAR	11/2002	11/2002
Consultation Document Energy, Environment & Transport (D3)	P	RE	WP1	ADELPHI	11/2002	11/2002
Consultation Document IC Technology & Transport (D4)	P	RE	WP1	ICCR	11/2002	11/2002
Consultation Document Modern Governance and Transport (D5)	P	RE	WP1	ICCR / ALAMO	11/2002	11/2002
Consultation Document Time-Based Implications … (D6)	P	RE	WP1	UWC	11/2002	11/2002
Joint Consultation Document (Integration D2-D6)	P	RE	WP1	ICCR	11/2002	11/2002
Impact of Non-Transport Policies on Mobility and Transport (D7) (including results of Delphi survey)	P	RE	WP2	NESTEAR	05/2003	12/2003[b]
A Procedure to Monitor Non-Transport Policies of Relevance to Transport (D8)	P	RE; TC	WP3	ADELPHI	10/2003	12/2003[c]
FINAL REPORT	P	RE	All	ICCR	01/2004	03/2004[d]

* C = confidential; R = restricted; P = public; RE = Report; TC = Technical System.

a. D1, chapter on ICT was revised following requests of the Commission submitted in the Fall 2002. The revised deliverable was submitted electronically 11/2002.
b. Version 1.0 submitted 10/2003 to Commission. Version 2.0 made available for the second round of expert consultations. Version 3.0 (final) submitted 12/2003. This was once again revised (Version 4.0) to take into accounts comments made at the final review meeting of the project and submitted 02/2004.
c. D8 comprises a monitoring system as an access database (TC) and a feasibility plan (RE) on the continuation of the strategic dialogue process
d. The first draft of the final report was submitted 01/2004 and discussed at the final review meeting. The final version was submitted 03/2004.

6 Results and conclusions

In this last chapter of the FORESIGHT for TRANSPORT final report we would like to highlight some of the substantive and methodological conclusions of the study. Substantive conclusions are those that concern the subject of the study, namely transport and mobility and how this is influenced by external non-transport policy domains. Our methodological conclusions concern the application and use of the foresight methodological approach.

6.1 What drives transport and mobility?

There are several external non-transport factors that may have an impact on mobility and the transport system. Some of these are easy to incorporate in strategic transport models since their impact on mobility is mediated through transport systemic variables such as costs or time that are easy to quantify and available. For many this is however not possible because they either operate outside the transport system realm proper – yet still impact on mobility – or because their impact operates on the micro-level which is neutralised through aggregation.

Starting from this realisation, the FORESIGHT for TRANSPORT study has had as main objective to clarify the *pathways* through which external and/or policy variables impact on transport and mobility. Our research has been motivated by two key considerations: first, to provide a framework for thinking through policy interventions while at the same time paying attention to the interrelationships between relevant factors; and second, to establish an analytical basis which is complementary to transport modelling and which, hopefully, is also used to advance the latter' theory and practice.

FORESIGHT for TRANSPORT has sought to link external variables to transport impact variables at both the macro- and micro-levels. At the macro- or aggregate level, the relevant associations were described through a reference scenario and a set of alternative scenarios. The reference scenario was detailed with the help of measurable indicators and projections based on expert judgement on how past and contemporary trends may unveil in the future. At the micro level, the impact pathway concept was used to describe the effects of very specific socio-economic, cultural and political trends on mobility and transport. Here the emphasis was placed on shedding light on the driving but also the intermediary role of developments operating outside the transport realm proper.

The scenarios for the future were elaborated through a strategic dialogue comprising five thematic expert panel consultations and validated through a

Delphi survey. The transport impact pathways were derived from the material supplied through the strategic dialogue and again submitted to validation through the Delphi survey. Using the latter input, a second (smaller) round of expert consultations was used to further elaborate these impact pathways.

6.1.1 Transport impact pathways

Let us begin with a presentation of our results and conclusions regarding the micro-level. Eighteen transport impact pathways were elaborated by the project and validated through the project's Delphi survey and second round of expert consultations. These impact pathways deal with the following subjects:

Regarding individual mobility and passenger transport

- The way ageing can be expected to affect transport demand as well as leisure patterns and the number of trips.
- The way in which the valorisation of time, speed and flexibility among the population influences motorisation as well as tourist travel patterns.
- The impact of attitudes towards the environment on the use of the transport system.
- The effect of the flexibilisation of the labour market, including the flexibility of working hours, on the type, length and frequency of local trips.
- The effects of the decentralisation of transport policy competences on urban and regional transport, including how conflicts on land use may affect network development.

Regarding (primarily) freight transport

- The impact of the emergence of a European level of decision-making with rising competences on network development and infrastructure investment as well as the role this has for a re-orientation of transport policy towards a new balance between modes and sustainable mobility.
- The role of technological innovation and diffusion – in general as well as more specifically with regard to alternative fuels and energy – on transport demand and on the environment (through transport).
- The way in which economic growth – in general and, in particular, in view of enlargement – can be expected to influence trade patterns and transport demand.
- The impact of restrictive migration policies on transport efficiency.

In the elaboration of the transport impact pathways we paid particular attention on specifying not only what drives developments but also what mediates development. External factors – including some not listed above – have in this respect often a much bigger role to play.

The comparative review of the transport impact pathways reveals a number of policy-relevant patterns. It is useful in this respect to distinguish between short- and long-distance transport and, in particular, passenger and freight.

Individual mobility and in that short-distance passenger transport is most open to external influences deriving from non-transport policy domains and relating to work, lifestyle, settlement and demographics. Keeping to the visual presentation of Figure 2 in chapter 3, it is in these more 'distant' policy domains that we must look for what drives and mediates change. The 'distance' of these policy domains from the core (of transport and mobility) also suggests that the changes thus effected are gradual and slow. It follows from this that, in order to be successful, mobility management within transport policy must elaborate strategies that are in line with contemporary forms of living and working and take into account demographic developments and settlement patterns. In addition, modern mobility management should try to effect changes within the above external policy domains that are consistent with sustainable mobility, for instance through the promotion of housing or labour market initiatives that take into account transport and environmental constraints.

Examples of possible local measures include: awareness raising campaigns targeting consumers and linking housing, lifestyle and transport; taxation incentives relating to transport plans worked out within firms; the implementation of work logistic structures through the diffusion, for instance, of ICT centres at community or district level; and the promotion of flexible, cheap and user-friendly car-sharing schemes at the urban level – all in conjunction with the improvement of the services supplied through public transport.

These recommendations are individually and in themselves not new. What is however different in our proposed way of approaching urban transport problems is the choice of perspective. The mainstream approach to urban transport management has been seeking to contain the increasing flexibility of travel that results from the flexibility of lifestyle and work by prioritising disincentives for travel in general and, especially, by car. Measures such as road pricing at the urban level, parking restrictions or the promotion of online shopping are parts of this strategy. However important such measures might be, they are unlikely on their own to bring about the desired effect and the reason for this lies with the utility as such of flexibility for the individual consumer and worker. Such measures should therefore be combined with measures which are more positive in orientation and seek to capitalise on rather than restrain individual autonomy.

The failure to place the consumer at the core also explains the low market share of the railways in medium- to long-distance passenger travel, especially the tourist segment. There is a potential for growth in this respect and not necessarily alone through high-speed trains which are more suited to metropolitan city tourism and business travel. Railway operators might have a lot to gain from paying closer attention to the leisure patterns and needs of two population segments in particular, namely, the elderly and families with children. In this connection more attention ought to be paid to establishing cooperation agreements with the tourist industry as well as the car rental industry similar to those of airlines.

Exploring further the leisure aspects of railway travel might also help to maintain a high level of service regarding regional and rural transport. The prioritisation of long-distance connections with a freight component in terms of railway investment has endangered the level of service and quality of regional railway networks contributing to an increase of the reliance on the car at this level. In this connection it might also be worth exploring further the possibilities for public-private partnerships for the operation of regional services. Such partnerships might be easier to consolidate at the local and regional levels than they are for long-distance connections regarding passengers. It is also important to recall the role of (railway) transport as a public service in decisions concerning subsidies, including at the level of the Structural and Cohesion Funds and bearing in mind the cohesion objective associated with the extension and completion of the TEN-T core and backbone network.

Turning now to freight transport we see that this is a field which is more 'closed' in the sense of having clearer and more restricted boundaries of influence. The core triangle of economy, environment and technology is what drives developments and change can also mostly be effected within this extended transport policy domain. A policy mix comprising investment, pricing (including environmental taxation) and technological innovations (with regard to new sources and more sustainable uses of energy as well as the deployment of communication technologies for advanced traffic management systems) is here largely adequate for effecting change towards sustainable mobility. The main challenge is, however, how to materialise such policy mixes at a broad scale. This is unlike individual mobility management which as we saw is operating much more at the local level, in terms of both geographical scale and scope. Insofar as long-distance freight transport is concerned, policies supporting the re-balancing of modes will only be effective if implemented at a broad level. This requires a re-thinking of decision-making processes towards better coordination and stakeholder involvement across countries and industrial sectors. The EU institutional framework provides a useful platform in this respect but is also comparatively novel. To this should be added that the need for policy harmonisation, which implies increased regulation in fields like state subsidy, environment and pricing, is frustrated by the deregulation of the transport market in terms of economic activity. Not without reason the European or

Common Transport Policy represents a master plan for the advancement and sustainable development of freight transport. Its success will however ultimately depend on the ability of the EU institutional framework to perform well as a multilevel governance structure.

6.1.2 Where are we moving towards?

How likely are we to be meeting the challenges raised above?

A review of present trends and their expert assessment regarding future developments suggests a number of positive elements in contemporary policies but also several problematic aspects.

Demographic trends speak for an ageing society. There has been a dramatic increase of life expectancy and this has resulted in an increase of the share of persons aged 60+. In conjunction with decreasing fertility rates and stagnating net migration, population growth is also stagnating. Till around 2020 the share of persons aged 60+ is expected to continue to increase at the present or a higher rate. A reversal of this trend is not expected after 2020 but a slow down is possible. As life expectancy is not expected to suddenly decrease, this could be the result of a gradual increase of fertility rates till that time.

Given the above it is not surprising that the population is expected to continue to stagnate or grow very slowly both in the EU-15 and in the New Member States. The current negative growth trend in the New Member States might, however, be arrested in the short- and medium-term thus bringing the rate of population growth there at levels more comparable to those in the EU-15 in the long-term.

In their overwhelming majority, experts consulted by the FORESIGHT for TRANSPORT project anticipate a trend break with regard to the average power of new passenger cars. This trend break is expected to occur in the medium-term, i.e. after 2010. Consistent with this, the majority of the experts expect that the contemporary trend towards the increase of high-speed train traffic will continue. These results suggest that we can expect a shift to more environmentally-friendly modes of transport despite the continuing preference for saving time and for speed. This has undoubtedly to do with the persistent positive attitudes towards the environment but also the greening of the car industry.

The contemporary trends towards the flexibilisation of work and the labour market are expected to continue. Part-time and telework will both continue to gain in importance at the same time that the employment rates stagnate. This is the case despite expectations for economic growth both in the EU-15 and in the

New Member States. In other words, the uncoupling of labour market demand from economic growth will continue into the future.

The flexibilisation of the labour market will be accompanied by the intensification of knowledge- and technology-related sectors. In their overwhelming majority, the experts consulted anticipate a further increase of the share of persons employed in the high-tech industry and of high-tech patents.

Economic growth, especially in the New Member States, is associated by many of the experts as closely linked to the project of European integration and the alignment of policy. The process of policy coordination or even harmonisation, which we have been witnessing since the beginning of the 1990s with the inauguration of the Maastricht Treaty, is expected to continue in the future.

No significant changes in the fields of energy consumption and environmental degradation are anticipated in the short-term. Both will continue to grow at a rate equal or higher to economic growth. But opinions begin to diverge quite significantly with regard to the medium-term and this allows us to talk about a possible trend-break in the long-term. It is furthermore expected that this trend-break will first occur at the generic level prior to beginning to also impact in the transport field.

There are several reasons speaking in favour of this long-term trend break. One is the share of renewable energies in energy production. The overwhelming majority of the experts consulted think this share will continue to increase at the current or higher rate and in a stable manner over the years to come. Another reason for this trend-break is the price of fuel. Both the prices for unleaded petrol and for diesel are expected to increase and do so steadily over the next years.

Turning now to transport. Transport demand grows currently at rates similar or higher than the rates of economic growth. This will continue in the short-term. In the medium and long-term a slow down is anticipated.

The anticipated positive growth of passenger transport demand will not necessarily be accompanied by a further increase in the rate of growth of individual motorised transport or aviation, whereby both are expected to continue to absorb a significant share of transport demand. The majority of the respondents is of the opinion that individual motorised transport as well as aviation will remain stable at a high level. Congestion will thus remain a problem for some time: less than 30 per cent expect less congestion in the future, even after 2020.

Experts assess freight transport somewhat differently: transport demand is expected to increase but in the long-term possibly at a lower rate than at present. A modal shift from road to rail is considered possible after 2020 by the

clear majority. This modal shift will come about not least through more investment into railways over the next several years.

The anticipated developments of contemporary trends presented above and based on the aggregate analysis of the responses to the FORESIGHT for TRANSPORT Delphi survey could be said to represent an assessment of the current situation and actual policies. The general view is that we can indeed observe a shift towards sustainable mobility. However given the slow pace of implementation of relevant policies (with regard to fuel prices, investment strategy etc.) and the likewise slow diffusion of innovations (for instance with regard to renewable energy) positive impacts in terms of environmental degradation or the re-balancing of modes is not expected to begin to happen prior to 2010. The White Paper projections on passenger and rail freight remain highly contested: around half of the respondents agree that passenger rail and freight rail will be increasing at an average yearly rate of 2.7 per cent, the other half disagree.

6.1.3 The visionary future

The future which represents the most desirable state of affairs is that which capitalises on the positive elements of the present and completely overcomes its negative aspects. This we have called the 'Sustainable European Ecological Identity' future scenario.

This visionary future is characterised by a new age balance at the demographic front; the prevalence of pluralism and tolerance in societies; a strong commitment to the welfare system and a parallel emphasis on regional development and cohesion; the promotion of cooperation and policy alignment within a flexible framework that respects subsidiarity; and the prioritisation of technological innovation towards overcoming some of the main problems faced today – both environmental and in transport.

The significant positive changes envisaged by this future are however ultimately made possible through a paradigm shift in values and the perception of life quality. This leads to massive CO_2 reduction through less materialism, less transport (both short- and long-distance), as well as different urban development principles. Ecological concerns and objectives determine economic goals and strategies rather than the other way around. This corresponds to a time economy that seeks time quality, synchronisation and punctuality and which, as a result, relies less on long-distance transport.

The above conditions were assessed as ideal by the respondents to the FORESIGHT Delphi survey but they were also judged as unlikely to materialise – individually and, especially, in their totality. The negative assessment of this future in terms of its probability of occurrence does not only reflect pessimism. A

certain pragmatism seems to be here at work in view of the real difficulties involved in optimising ecological, social and economic needs and doing this in an almost conflict-free manner.

6.1.4 The negative future to avoid

We have named the negative future state of affairs 'Governance Failure'.

This negative future prioritises the negative elements of the present and expects these to become worse in the years to come: there is a continuation and aggravation of contemporary ageing trends, social inequalities increase and transport problems in terms of congestion and environmental degradation persist and are heightened. This is caused by the prolongation of economic recession in conjunction with technological breakdown.

The reason for calling this negative future state of affairs 'governance failure' has to do with the failure of existing institutional arrangements to deal with negative developments. Indeed the fact that decision-making is centralised and follows a hierarchical technocracy logic paying little attention to national and sub-national levels of government makes it incapable to address social problems. As a result we observe a marked polarisation within societies across the urban / rural dimension and cultural / religious traditions. As difference is not tolerated there is friction and conflict. Mistrust in political institutions increases and this leads to the strengthening of right-wing extremism. Enlargement and, more generally, the project of European integration is arrested and ultimately breaks down.

6.1.5 Positive and plausible alternatives

There were two alternative future that were identified as both positive and plausible scenarios for guiding present developments. The first is 'Federal State Europe', the second 'Local Governance'.

'Federal State Europe' anticipates the consolidation of a state political system at European level following federalist provisions. This makes it possible to establish a multilevel governance system based on subsidiarity. This supports the coordination of policy where necessary on the one hand, while leaving adequate room for the local appropriation of policies, on the other hand. This dual strategy is of particular significance for dealing with the problems of freight and passenger transport respectively. Freight transport necessitates strategies implemented on a large scale. The problems of passenger transport can be dealt in a better way at the local / regional level in close coordination with key non-transport domains such as housing, urban and labour market policies. The

close coordination between economic and social objectives under 'Federal State Europe' supports this approach.

'Local governance', the second positive plausible future, prioritises environmental sustainability and social / regional cohesion over economic competitiveness. This is possible without major loses in terms of welfare at the sub-national level – quasi a Europe of the regions – and assuming a strong technology policy and an active voluntary sector in terms of social policy.

6.2 Lessons for foresight

Turning now to methodology, it is important to recall that the FORESIGHT for TRANSPORT study has been the first foresight exercise in the transport field at European level. Moreover, it has been the first foresight exercise ever to concentrate so consistently at the interface level between various policies and fields of inquiry in adopting a forward-looking outlook.

From this perspective the lessons to be drawn from the FORESIGHT for TRANSPORT are of great significance for foresight practitioners in transport and other policy areas. These can be summarised as follows.

6.2.1 Why foresight?

The approach followed in FORESIGHT for TRANSPORT differs from that adopted by strategic modelling exercises that deliver forecasts regarding transport developments and, on this basis, an assessment of impacts. To reiterate, our study instead focused on unveiling *how* changes within the external or policy environments come to impact on transport and mobility. The key term here is 'how', hence also the organisation of our research around the notion of 'impact pathway'.

It is this emphasis on the process rather than the quantifiable outcome that has led us to choose foresight as a methodology for the present study. Understanding process in conceptual terms implies integrating specialised knowledge as well as different normative appreciations regarding the future. The foresight methodology is a good methodology when concentrating on issues which are process-oriented either substantively in terms of scope and content and/or with regard to actors involved.

What a foresight exercise cannot deliver – and what it should not be expected to deliver – is quantifiable and objective evidence-like statements or projections about short-term developments or impacts.

Substantive and long-lasting transformation only comes about through the accumulation of several smaller-scale and often disparate – at first sight – actions operating at the interface of policy domains rather that within any single perspective. This is because of the increased conditionality or factor independence in modern societies – itself the result of the increased knowledge and autonomy of individual actors. Foresight exercises, unlike mainstream transport modelling, can help identify such interfaces. Furthermore, in following the network logic, foresight exercises help bring relevant actors together, thus assisting in the drawing of interconnections at the level of action.

6.2.2 What methods to use and how to use them

The emphasis on process leads to the participatory approach which is at the core of a foresight exercise. This in turn prescribes the use of creative / consultation methods such as expert consultations, brainstorming and scenario-writing. These methods allow the gathering of specialised information, its integration as well as its validation through reflection. At the same time foresight has the advantage of raising awareness among participants regarding transport policy and how it is related to other policy domains.

Important preconditions for these methods to also meet their objectives are:

(b) the instalment of a core group of researchers or moderators who can follow the various deliberations on a continuous basis, filter and integrate their outputs;

(c) a generous time framework.

Insofar as the time framework is concerned it should be underlined that the two years of the FORESIGHT for TRANSPORT project can at best be thought suitable for a pilot exercise but should not be taken as a benchmark for a strategic dialogue. This is in part because future estimations are long-term and must be revisited at regular intervals. An equally important reason has to do with the time that is necessary for deliberations as such, especially when these happen in part virtually or at a distance. A Delphi survey, for instance, can only provide reliable results if it achieves a reasonable response rate and this is not easy to achieve within a limited time framework.

The reliance on external expertise as well as the requirement to cover as many alternative views as possible means that a key element of a foresight exercise and perhaps of its success lies in the adequate and representative selection of experts and stakeholders to participate in the workshops and/or Delphi survey.

Assembling a group of experts from different disciplines and specialisations and keeping their interest in the exercise over a longer period of time has been the

main challenge faced by the project. Without the insight possible through a multi-disciplinary team, a foresight exercise is probably of little use or might indeed lead to wrong conclusions or predictions. This is because the discussion of the future necessitates at the same time vision (to think in future terms) and very specialised information about past trends and causal relationships. Such a specialised information can often only come from persons who are experts in very specific areas. Such very specialised experts might, however, have little interest in foresight exercises which are ultimately tailored to the needs of areas which are beyond their area of expertise. Herein lies the main setback of foresight as a method.

It is also for this reason that the FORESIGHT for TRANSPORT team has placed so much emphasis on establishing a monitoring system which gathers knowledge or information on where expert knowledge can be obtained. Modern knowledge management tools are clearly no substitute for deliberations involving a multi-disciplinary expert team. However they assist with the gathering of information and the identification of expertise when and where it is needed.

6.2.3 Integrating expert judgements and formal analytical methods

One of the objectives of the FORESIGHT for TRANSPORT study has been to assemble and present knowledge that might be useful for refining strategic transport models.

The present state of development of transport models does not allow the appropriation of much of the information presented in this report and operating at the micro-level. This is because most existing models are static and relying on algorithms based on observable relations measured on the aggregate level. The majority of the transport impact pathways, on the other hand, operate with latent non-linear variables. This said, an interesting application would be to use the projections of contemporary trends made by the FORESIGHT Delphi experts to refine growth or extrapolation functions and to compare the results with those achieved using standard calibration methods.

In terms of policy, the results presented by this study and based on a social scientific assessment of expert judgements are complementary to those produced by formal analytical methods. The latter say something about relationships and impacts on the aggregate level. These are important as benchmarks regarding broad outcomes. However, it is not possible to deduce from these degrees of association among specific variables at the micro-level. Yet it is the latter type of information at the micro-level of policy implementation or results that is needed for designing good policy.

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Notes

[1] This follows the ecological modernisation perspective in sociology and policy (cf. Hajer 1994; Giorgi and Redclift 2000 a & b).

[2] The names of the experts participating in the first round thematic consultations can be read in the consultation documents (Deliverables D2 to D6) and on the project's Web Site at http://www.iccr-international.org/foresight

[3] The names of the experts participating in the second round consultation can be read in Deliverable 7 and on the project's Web Site http://www.iccr-international.org/foresight

[4] It is worth here noting that the brainstorming sessions of the first round of the expert consultations were recorded. The recordings – amounting to around 24 CDs of four hours each – and/or transcriptions were used for the compilation of the consultation documents and the preliminary definition of the transport impact pathways for the FORESIGHT Delphi survey.

[5] A description of the fieldwork for the Delphi survey organised by the FORESIGHT for TRANSPORT project, including the names and institutional affiliations of the respondents (waves 1 & 2) can be read in the Annex of Deliverable 7 which also summarises the findings of the survey. The questionnaires can be downloaded from the project's Web Site at http://www.iccr-international.org/foresight. This also includes a visual presentation of the results.

[6] This is the subject of the EU-US Scientific Seminar on New Technology Foresight, Forecasting and Assessment Methods, 13-14 May 2004, Seville, Spain.

[7] One prominent example of failure of the simple parameter logic that pays little attention to contextual factors is the diffusion of the UMTS technology. Several licenses were sold towards the end of the 1990s at very high prices. The expectation at the time was that this new technology would revolutionise mobile communication. What was not taken adequately into account at the time – especially by the future providers – was the speed of improvement of the existing technologies and the question of utility of additional communication components for mainstream users (in relation to the very high costs of additional investments needed to build up a network). It still remains to be seen whether UMTS manages to establish a leading position. At present, however, this does not look very likely.

[8] This, according to Stehr, is the main characteristic of the knowledge society which is gradually consolidating itself in modern times.

[9] Most EU-15 Member States are in fact planning to impose restrictions on migration from the new Member States for a moratorium period of up to seven years.

[10] The recent debate at the level of the European Convention (in the framework of the Working Group 'Social Europe') on whether 'full employment' as opposed to 'a high level of employment' should be part of the Union's social objectives testifies to this.

[11] These are all surveys that are already harmonised within Member States under the coordination of Eurostat. The Survey on Income and Living Conditions is the follow-up survey of the European Community Household Panel Survey (ECHP).

[12] This is evidenced not only by the increasing motorisation rate but also the increase of the average power of motor vehicles.

[13] This said there is quite some variation among New Members States. The most advanced in this respect is Hungary which had a tradition of social reporting already during the former Communist era.

[14] The FORESIGHT for TRANSPORT monitoring system also includes information on a number of indicators that describe the transport system: road, rail and maritime freight traffic; airline and rail fleet; registration of new road vehicles; employment in road transport and staff of rail operations; length of transport network; transport infrastructure investment; accidents; road user taxes and motor vehicle taxes; combined road-rail capacity; modal split for freight at national level. Needless to say information systems that solely concentrate on transport are more suitable for gathering information on

transport system variables. One such system currently in the development phase is the European Transport Information System (ETIS).

[15] The questionnaire in fact requested from participants to answer these questions with reference to that scenario of their choice which represented the most desirable state of affairs for the future. Around 85 respondents answered this set of questions. The majority chose between three positive scenarios as baseline, namely, 'Federal Europe', 'Local Governance' and 'Sustainable European Ecological Identity'. However the comparatively low number of responses does not allow a reliable analysis of the answers by scenario. Thus the answers were all pooled together and used to describe the reference scenario.

[16] The mean value of assessments of this scenario on a scale of 1 to 5 where '1' meant very likely or very desirable and '5' least likely or least desirable was 1.6 in terms of desirability and 3.6 in terms of likelihood. In the second wave of the Delphi survey this scenario received 46% of preferential votes but its probability of realisation was assessed as 0.22.

[17] The following description corresponds to that presented to the experts participating in the FORESIGHT for TRANSPORT Delphi survey. The same is the case for the plausible negative futures in the next section.