THEMATIC NETWORK TO UNDERSTAND MOBILITY PREDICTION

FINAL PUBLISHABLE REPORT

Think-up – Contract N°.GRD1-1999-11236

Project Co-ordinator: NESTEAR, France

Partners:
IWW, Germany
ICCR, Austria
NEA, Netherlands
NETR, France

PROJECT START DATE : 01/05/2000 DURATION : 30 MONTHS

April 2003

PROJECT FUNDED BY THE EUROPEAN COMMISSION UNDER THE TRANSPORT RTD PROGRAMME OF THE 5th FRAMEWORK PROGRAMME
**TABLE OF CONTENT**

**TABLE OF CONTENT** ................................................................................................................... 2

**I – EXECUTIVE SUMMARY** ........................................................................................................ 4

**II - OBJECTIVES OF THE PROJECT THINK-UP** ......................................................................... 7

1 – General objective .......................................................................................................................... 7

2 – Objective of the organisation of the work .................................................................................... 8

3 – Objectives relative the content .................................................................................................... 9

4 – Implementation of the objectives within the THINK UP progress ............................................. 10

**III - SCIENTIFIC AND TECHNICAL DESCRIPTION OF THE RESULTS** 11

**A - SEGMENTATION OF FREIGHT TRANSPORT MARKETS** .............................................. 14

1. The Users Side Segmentation ........................................................................................................ 17
   1.1 The Logistic Integration into the Supply Chain ........................................................................ 18
   1.2. Situation of the Users in the Transport Chain and Spatial Differentiation ............................. 20
   1.3. The Load Unit Segment .......................................................................................................... 22
   1.4. First Conclusions for « users » segmentation ........................................................................ 23

2. Service Providers Side Segmentation ............................................................................................ 25
   2.1. Rail Operators and Reorganisation of Business Units ............................................................ 25
   2.2. Segmentation of Road Production Process at a European Scale ............................................. 26
   2.3. The Integration of Short Sea Shipping and Ports Activities in the Maritime Transport Chain ... 31
   2.4. A Search for Complementary or Substitution of Air Freight Transport ................................ 36
   2.5. Conclusion for segmentation from an Operator Side ............................................................... 38

3. “Cross-Segmentation and Trends in Freight Transport Markets” ............................................. 40
   3.1. A first basis for cross segmentation ........................................................................................ 40
   3.2. The Spatial Dimension as an Instrument of Policy Decision ................................................... 43
   3.3. Cross-segmentation of Intermodal Transportation considered as one Mode ............................ 45
   3.4. Conclusion of the trend analysis for the cross segmentation .................................................. 48

4. Evolution of Segmentation of Freight Markets ............................................................................ 52
   4.1. Trends of Logistical Systems and Changes in Segmentation .................................................. 53
   4.2. Impact of the Transport Policy on Transport Modes Freight Share ....................................... 57

5. Conclusions and consolidation of the cross-segmentation ............................................................ 60

**B - SEGMENTATION OF PASSENGER TRANSPORT MARKET** ......................................... 63

With a slight difference as regards freight segmentation, analysis of trends come earlier in the process ........................................................................................................................................ 64

1. Relevant future developments ........................................................................................................ 65
   1.1. Demand side trends ................................................................................................................. 65
   1.2. Supply side trends .................................................................................................................... 69
I – EXECUTIVE SUMMARY

THINK UP is a thematic network of the Vth Framework Research Programme whose objective was to develop a “common platform of understanding” for transport forecast in Europe.

This meant first to contribute to the development of demand forecasts for year 2005/2010, 2015 and 2020 which was the expected outcome of the project EXPEDITE ; THINK UP and EXPEDITE have worked in close relation all along the life of these two projects for the definition of the modelling tool, the scenarios to be tested as well as for interpretation of results, concerning in particular trends and transport, and modal shift.

The methodology defined for THINK UP was first based on an analysis of the segmentation of transport market, since transport segments for short and long distance, passenger and freight, transport segments according to the purpose of trips or type of logistic organisation do not follow the same trend, obey to the same driving force, or face the same conditions of competition between modes.

This question of modal shift which is essential in the implementation of Common Transport Policy was also in the centre of THINK UP work in the segmentation exercise with the definition of relevant trends for transport sector : for each mode the transport segments had also to be identified as “core and competitive” segments in order to define relevant policy measures for inducing modal shift ; in the course of the project these markets were re-termed “sensitive” and “insensitive market” segments in order to stress that a dominating position of a mode, or on the contrary the marginal role of a mode on a segment cannot be considered as definitive position in the long run.

As a thematic network, THINK UP was organised as a network of transport experts from many different sectors : policy makers, service providers, users and researchers. National representative of transport ministries involved in traffic
forecasts of national master plans have also been closely associated and regularly invited so that they could follow the different steps of THINK UP work from segmentation of the market, to modelling choice and presentation of forecasts so that they could bring their experience, and facilitate common interpretation of national and European results.

The THINK UP work plan was divided in 4 thematic tasks

- Segmentation of demand and supply of passenger transport markets
- Segmentation of demand and supply of freight transport markets.

For both tasks users and service providers have help to define homogenous demand and supply segments from which it was possible to interpret major changes in trends according to changes in demand requirements and evolution of performances of the transport operating system: for each domain the aim was to define 10 to 20 segments with a number of criteria which remains manageable for prospective analysis, keeping possibility of further desegregation if necessary.

- Policy variables for mobility prediction

In this task focus has been put on the policy context, but also in the implementation context of the forecasting exercise: policy content defines the policy measures or policy “bundles” to be tested, but the definition of the contextual scenarios, the type of information used, the possible impact of non-transport policies have to be also taken into account. A particular importance was given to the contribution of different institutional levels, regional, national, European in the building of a consensus on forecasts as well as in evaluation of policy measures for modal shift.

- Projection tools and trend estimations
The state of the art of projection tools presently utilised at national and European scale has been reviewed stressing in different families of models bringing their own advantages but also their own limits. Experts did recognise these varieties of tools, the influence they might have on results if necessary cautious are not taken in consideration and also the fact that there does not exist a model which can encompass all the questions raised. Combination of models can be sometimes be envisaged when cooperation is effective between modelling teams. In the modal split modules intermodal transport is rarely introduced in a satisfactory way and cannot be always considered as a specific mode: it is often after assignment on the intermodal transport European network that the best combination of modes, between rail, road and inland waterways but also between sea mode and land modes can be observed. Assignment on network phase of modelling becomes a more and more important phase for national and European models which have to be adapted.

At the end of THINK UP project 12 workshops have been held in different European capitals with a good follow up of national and professional experts, taking part in several of these workshops in order to be better involved in the process of consensus building. EXPEDITE experts participated to most of these so that conclusions could benefit to the projection exercise running in parallel. 3 large seminars have also been held so that synthesis could be made and forecast results discussed. The final seminar was held in Brussels on the theme of “potentials for modal shift”. A web site was kept open until end of 2003 in order to keep participants informed of THINK UP progresses and to disseminate the large number of contributions which have been collected.
II - OBJECTIVES OF THE PROJECT THINK-UP

1 – General objective

The main objective of the project THINK-UP was to build a “common platform” of understanding for transport projections, so that co-operation in the definition of the transport policy, and in particular for long term decision process, could be facilitated and strengthened.

Co-operation and co-ordination becomes indeed a more and more important necessity not only between the countries or regions but also between different types of institutions which operate at different level: first there is the European Commission with the definition and implementation of common transport policy, then the members states which develop national transport policy, and most of the time concentrate on long term national flows and more and more frequently regions which take an increasing role in transport policy definition in parallel with local institutions, acting in urban areas. All these interventions have to be made in a consistent way so that general goals of sustainable transport policy can be reinforced: from that perspective it is then clear that a common understanding of transport evolutions, according to different transport “stimulus” or policy measures is a very important prerequisite for co-operation in definition of a policy as well as for acceptance of such policies in implementation process.

This global objective had consequences on the way to proceed, concerning the content of the work but also the organisation of THINK-UP thematic network.
2 – Objective of the organisation of the work

- Concerning the organisation of THINK-UP this meant several things:
  
  - First the proposed choice by the Commission of a thematic network framework as opposed to “project” solution implied an “open work”, with, in particular, the participation of national representatives of ministries as well as participation of transport organisations: for national representatives, it was even expected a continuous follow-up along the entire project with participation to several workshops or seminars so that exchanges could be deepened during the life of the project. The importance given to the website, the volume of information put in this website of THINK-UP also reflects this intention to widen and open the participation.

  As a consequence all the material collected was public information.

  - Secondly, the continuity of the THINK-UP work as regards the IVthe Research Transport Programme, which meant taking into account former research results, related to THINK-UP and more generally related to traffic projections: in addition to presentation of national models and plans, THINK-UP gave also an opportunity to present results of achieved research projects related on transport scenarios: SCENARIOS, STREAMS, SCENES, CODE-TEN… in which core team members had been involved. Closed links were built with SPOLIGHT thematic network running in parallel, more concentrated on the inventory of tools.

  - Thirdly, and this was a strong originality of THINK-UP, the very close association to EXPEDITE project which was developing the model for traffic projections; this meant that choice of variables, choice of scenarios, relevance of model structure were discussed and EXPEDITE team
participated to all the THINK-UP workshops and seminars. A joint scientific and management committee has been created with participation of the Commission. This has certainly considerably helped a wide exchange of information and a more efficient sharing of the work between a team which followed objectives about transport projections definition and use, and a team which had to adapt the tool and provide in parallel projection results to the Commission.

3 – Objectives relative the content

Concerning the content of THINK-UP, the orientation of the work followed from two basic assumptions, which can appears as fairly simple, but which have rarely been taken fully into consideration in the projections and transport decision process related to long term scenarios.

- First the fact that there is not “one” market of transport but different market segments of transport with contrasted trends and quite different logic’s of development: this means that a global estimation on transport trends does not help very much in the understanding of transport evolution. Identification of main drivers and choice of policy measures have to be adapted to market segments in order to provide a more relevant understanding or to point out a more efficient.

- Secondly, the fact that political choices are more and more important for transport evolution in a context where transport “predictions” are more and more difficult to achieve ; this is why the word “projection” has often be preferred to the word “prediction”. Focus is put on “political scenarios” and variables which reflect such scenario..

- Thirdly, the importance given to modal shift which is a major objective of the “white paper” published by the Commission in 2001: to favour a modal shift means to focus on “segments”. Segments of intermodal transport were of particular interest in the THINK-UP project.
4 – Implementation of the objectives within the THINK UP progress

These objectives have been applied in the different work packages. For the segmentation it was necessary to split the analysis of the market between two groups specialised respectively in passenger and freight transport, co-ordinated by IWW and NESTEAR.

The policy analysis and analysis of explanatory variables and scenarios was done in a work package co-ordinated by ICCR, which proposed policy entry variables to the modelling team of EXPEDITE.

Finally, a specific work package was devoted to the analysis of tools, under the co-ordination of NEA in order to stress their potentiality and limits for transport projection and simulation; within this work package NESTEAR and NEA have created a specific “tasked force” to deepen the investigations and point differences between models results coming from either the structure, the mathematical formulation or the data used to calibrate the equation.
III - SCIENTIFIC AND TECHNICAL DESCRIPTION OF THE RESULTS

Following the THINK UP approach the scientific and technical description of the results can be divided into 4 parts.

The first two parts relate to segmentation of the transport market with a distinction between passengers and freight.

The third part relates to the policy context and the introduction of policy variables or scenarios in the transport projects.

The fourth part relates to the comparison of the models used at national and European level, including discussion with EXPEDITE team in order to provide to the Commission, within the time constraints of the project, the best answer possible for projections.

For the segmentation of the market the different steps have been developed in parallel and discussed within workshops and seminars which took place at the same time, at the same place.

The method chosen was:

- first make a segmentation of the market from the users point of view with THINK UP workshops 1/2 the 14 of December in Dresden, Germany
- then make a segmentation of the market from the service providers point of view with THINK UP workshops 2/3 the 15th December in Dresden, Germany
- then in a third step to make a cross segmentation of the market on the basis of results of two previous workshops and checking at the same time the stability of such segmentation over time, with an investigation on trends of market segments; this cross segmentation discussion took place for
passengers and freight in a workshop held in Naples (Italy) the 29 and 30 of March 2001.

In a final seminal (7/8 June in Berlin) a final common discussion for freight and passengers, allowed to validate main results, so that, at the end, a manageable number of segments 15 to 20 could be presented.

The idea of cross segmentation and analysis of the stability of the segmentation over time is fairly original. So far the segmentation has often been limited to demand requirements.

In THINK UP the ability of service providers to face such demand requirements is also considered taking into account the operating constraints of the modes and the entry in the market of new operators and service providers. The analysis of the relevance of a segmentation in ten to twenty years from now also appeared to be quite interesting in order to identify major logistic families for the future and to take some distances from a detailed analysis of the purpose of trips or the type of goods.

To summarise this common approach for freight and passengers it must be stressed :

- Different segments have different trends; trend is itself a first discriminating factor (or variable) between segment.

- The competitive situation between modes differs from one segment to another. And there are «core» and «competitive» segments. In a core segment, a mode of transport is dominant, which is not the case in a competitive segment. Such contrasts were also a major element of the segmentation foreseen.
The environment of a segment must not be analysed from a static point of view, but in relation with the evolution of user requirements, with changes in production conditions involved by the introduction of new technologies, in order to be able to understand long term trends in transport.

The global policy context is also considered within the work of segmentation. And a final goal of Think-up is to point out possible impacts of policy measures, which can change the present modal split.
A - SEGMENTATION OF FREIGHT TRANSPORT MARKETS
For freight transport the classical distinction between type of products is not relevant anymore; new elements like shipment characteristics, logistics requirements of the shippers, operating constraints of transport companies need to be introduced.

By contrast, the multiplication of “dimensions” that will be included in the segmentation must not lead to a too large number of segments, giving a too detailed or complex segmentation. So, the objective is also to identify at the end a “manageable” number of segments.

Think-up Workshops are conducted in close links with EXPEDITE project dealing with modelling and transport forecasts. But at the first stage of the analysis, modelling constraints are not taken into account. Models are very much constrained by the existence of statistics, which often cannot describe properly the structural change. This problem will be tackled late when an attempt will be made to “bridge” segmentation conclusions with models development.

Concerning the segmentation, the distinction between the “user” point of view and the “service provider” point of view can be stressed at different levels:

- **Logistics constraints:**
  - On the one hand: Users are facing profound changes in supply chain management, and transport requirements reflect this evolution in production conditions of goods: industrial logistic organisation influences transport logistics. (e.g: outsourcing)
  - On the other hand: the competitive environment (related to the mode as well as to the transport chain) is well known by the operators. Operators are also facing operating systems constraints, e.g management of rolling stocks or equipments.

- **Decision-making process in the modal choice:**
- Transport users require transport services and the modal choice is linked more to the provided service and its ability to satisfy their demand than to the mode in itself.

- Transport operators and forwarders, prioritise more often a modal solution, diversify the services provided and in case of international and intercontinental transport promote multimodal solutions. The difficulty in the segmentation is the multi-functions of the transport operators (e.g. terminal operators, ports operators, logistics providers…) which do not enable a clear classification considering only the mode as a core element of segmentation.

That is the reason why, the two complementary Workshops have been organised independently, focusing and enlarging respectively on the two approaches. The confrontations of the two approaches will occur in a second step within a cross segmentation.

All the contributions presented during the 2 days are including in the Deliverable, according to the synthesis plan.
1. The Users Side Segmentation

In the transport literature and in the 4th Framework Programme of the European Commission, many segmentations of the market have already been done from the “user” side. The objectives were, in most of cases, a better understanding of the customer needs in a market approach. But logistic constraints and supply chains management have taken more and more importance as regard the more classical indicators price (time, frequency, flexibility) and quality criteria and represent new factors to be integrated in the segmentation.

However each objective did present significant differences, stressing more the logistic context or more the specificity of the modes so that conclusions could be drawn as far as transport policy is concerned:

- The REDEFINE project stressed on logistics characteristics of the transport chain in order to analyse the coupling/de-coupling effects between economic activity and road traffic.

- SOFTICE project focused on road scenarios and on the impact of the evolution of road costs on traffic. (Annex C)

- IQ project concentrated on the intermodal market and on the transport of unit load (maritime containers, swap bodies, semi-trailers). (Annex A)

- EUFRANET project explored rail strategies (for a renewal of rail).

However, differences exist as regard the impact of user decision-making processes on logistic organisation and modal choice.

In parallel, modelling researches are built on an implicit (in doing the choice of the variables) or explicit segmentation of transport demand when calibrating a demand function. The segmentation of the SMILE and TEM models was essential
in the modal definition. Shippers Surveys (national surveys and pilot study of MYSTIC) were built on a formalisation of the transport chain organisation.

All these former results have been reviewed at the Workshop on the segmentation from the user’ point of view as regards Think-up objectives.

In order to define a consistent segmentation the major axes of the transport market analysis have been discussed:

- The logistic integrated process of the transport market from supply chain management to transport.
- The position of the users in the transport chain (producer or distributor) and the spatial differentiation
- The load unit transport approach.

These segmentation approaches are not incompatible; each one just prioritises a different aspect and the problem of the synthesis is to propose a common set of variables for segmentation.

From a classical market segmentation, per type of product and per mode, the user now prioritises a segmentation related to the structure and the organisation of the logistic chain. The transport mode is often a secondary consideration, thus the success of road is not the success of the mode in itself, but its ability to be integrated into a logistic chain.

### 1.1 The Logistic Integration into the Supply Chain

First of all, the logistic integration -within the supply chain- does not mean at all a uniform trend of the transport chain organisation. Differentiation of transport chains might be even more important than before and clearly different transport needs exist according to the logistics “profile”. A logistic profile is also
determined by a set of variables or components, which represent major transport variables of the new segmentation.

In this global approach, three different levels are taken into consideration. They form a common background to the market analysis:

(a) the production / consumption equilibrium process
(b) the logistic service level which deals with physical distribution of products
(c) the market of transport services

The first level determines the demand volume. The introduction of the second level is very important to understand the evolution of users requirements. Big changes affect this level in two main directions: custom and service responsiveness (flexibility). Both lead toward a service tailored to individuals needs. Finally, the interaction between the three levels defines the supply chain management.

In the study of logistics services, a very important point is the location of “warehouses” or distribution centres: logistic is a trade often between economics of scale (for transport) and immobilisation costs (value of time). Two important indicators can be chosen as “proxy” to take into account these evolution:

- The “lead time” (time between the order and the delivery) which can be decomposed as follows: “less” than a week, a week, “more” than a week;
- The “shipment size” which has been split into: “less” than truck load, truck load, “more” than truck load, in the SMILE analysis.

Value of the product and density are also important indicators which relate to shipment size and lead time.

With three shipment sizes and lead time categories nine segments are obtained. In all the segments, the road mode is dominating with up to 80 to 85% of the
transport market in the Netherlands, but some competition exists with rail or inland waterways.

A more detailed segmentation for the “more” than truck load shipment (e.g. constructions materials, raw materials, industrial product) will probably show more differences as regard modal share for some market segments with a stronger position for waterways and rail (iron ores, coal, petroleum products, cereals…)

These three levels of framework for analysis and these two segmentation variables appear as an important basis for the users point of view segmentation, because they are able to take into account major evolution.

1.2. **Situation of the Users in the Transport Chain and Spatial Differentiation**

One admitted the principle of segmentation along different logistic transport chains from producer to consumer, the question arises of segmentation according to the position of the shipper along the transport chain.

Is it relevant to make a distinction according to the type of decision maker, industrialist or distributor? What is the differentiation between what is called B⊗B (Business to Business) market and B⊗C (Business to Consumer) market. E-commerce is making such a distinction. The development of “Interplant” relations and the deep changes which occur in the organisation push for such complementary segmentation.

Furthermore to take into account the constraints of physical distribution in the logistic chain, it has been stressed that location of warehouses are essential (cf.(1)): local evolution of warehouses affects particularly the evolution of distribution which in the definitive affects the storage strategy of industries.

In the shipper survey the shipment size is also stressed as being a very important factor, unfortunately few statistical information is also available
Another important element is the transport equipment of the shipper: there is a difference between transport for own account, hire and reward. The borderline between these two types of organisation has changed quickly during the last twenty years, in favour of subcontracting transport to transport operator and now in favour of subcontracting logistic services including handling and storage.

In the statistics produced in the REDEFINE project, sometimes difficulties appeared to integrate the evolution of handling factor. These factors reflect the change in pattern between “multileg” and one leg transport\(^1\). Very detailed analysis in terms of types of product and logistic distribution chains are necessary. Such detailed analysis would be also necessary for the “loading” factor evolution which is the result of two opposing factors: the consolidation of flows for long distances haulage to benefit from economies of scale and the breaking down of diffusion of flows (or collection of flows) because of the decrease of shipment size or the interdiction using more than 3.5 tons trucks in city centers.

Nevertheless, in our segmentation analysis it is clear that such details cannot be included and would even make it more difficult to make a strategic synthesis for the position of modes in the future.

A good, fairly single way, to introduce all these factors would probably be to distinguish “interplant transport” from the distributor and to consider the transport chain across the different spatial levels: international, national and regional. By doing this, logistics constraints, location of warehouses would be taken into account given a supplementary dimension or precision of the shipment size question which is essential and cannot be tackle easily without much details and statistical information.

The introduction of a spatial dimension, which is related to the transport chain organisation and to the number of “legs”, presents an other advantage for further modal analysis. At each spatial level, different public authorities intervene and
influence modal shift with either intervention in market rules (European level for non-discrimination) or on land use policy (for local implementation of distribution centre for example). Nevertheless, the interdependencies are always partial: distribution pattern is also concentrated at a European level and not only at regional levels as shown by the European Distribution Centre implementation in the northern range.

Therefore a “transversal” segmentation of the transport logistic chain from producer to consumer could be along these two lines:

- Type of decision maker or shipper (producer or distributor)
- Spatial level which would complement the information as shipment size and enlightens the strategic problems of transport stemming from the ability to concentrate and diffuse flows in the most efficient way.

But by doing this the complex problem of long distance intermodal transport chain and a multi-leg international transport chain will not be probably completely and properly be taken into account; therefore it is proposed to analyse it at this stage in a specific category.

1.3. The Load Unit Segment.

Load Unit techniques have been introduced to facilitate handling problem in seaports at the beginning; and then it has been developed in the other transport modes to resolve logistics constraints. This, influences not only the transport chain organisation but also the shipper logistics. Load unit techniques should be developed more and more; it is even becoming “the” transport techniques of the intercontinental trade for all general cargo (maritime container), which is in itself a transport mode increasing very quickly across the world.

\[1\] One leg transport and several legs transport are differentiated. A « multileg » transport does not mean a transfer of mode.
Within Europe, intermodal transport and Short Sea Shipping will develop faster and will be prioritised for crossing national barriers (Alps, Pyrenées, maritime straits..) or sensitive areas (protection of nature and urban areas). Therefore such a segment would approximately complement the first variables of segmentation proposed: it is a segment justified by the integration principle of the logistics chain (although distribution and distribution/collection of products contained in load unit can also be studied as a specific segment).

The load unit market was studied in the IQ project. For modal choice, it was stressed how important were the consolidation process of unit load flows in order to run shuttles/block trains and benefit from economics of scale. This has been confirmed by examples given for transport flows from Scandinavian to Central Europe and this will be further developed by putting this in relation with transport operator approach.

1.4. First Conclusions for « users » segmentation

At this stage of the analysis it is only possible to sketch a first proposal for the choice of segmentation variable or segmentation process. Then, the operator approach will be developed.

- First, major bulk flows are isolated: construction material, industrialised basic products and raw materials, petroleum.

- Secondly, introduction of shipment size in the remaining transport market (general cargo) as well as lead time.

- Third, the shipper profile is taken into account with a minimum distinction between industrial producer and distributor. (Segmentations are interrelated but not fully dependent)

- Fourth, differentiation of spatial levels.
Finally, transport of load unit is considered separately, as a part of logistic chains from producer to destination.
2. Service Providers Side Segmentation

The second Workshop has highlighted the service providers approach. Operators of specific modes and terminals operators have been assembled to present their approach of the freight transport market.

2.1. Rail Operators and Reorganisation of Business Units

Rail companies are restructuring their business units, in particular the freight commercial structure, within a more general reorganisation, which affects the use of infrastructures and the use of rolling stock. Freight commercial units are industrialised and develop specific strategies.

For instance, in France, the SNCF has set an “industrial plan” including the ambitious goal of doubling rail freight by 2010. 600 locomotives will be bought for freight transport. A special effort will be made for intermodal transport on major transit routes through France, across the Pyrenées and the Alps: a tripling of intermediate transport by 2010 is the objective.

The case of the Deutsche Bahn has been presented more in detail. Commercial units are divided into major rail markets and for each market specific logistics are provided. Most of the traffic come from large industrial companies and efforts are made to adapt rail logistics to the industry needs, including the new logistics needs of basic and intermediate industries. New markets are also explored for transport of waste, construction materials, and for large-scale distribution of consumers’ goods (supermarkets). In the strategy of Deutsche Bahn, as in the Kombiverkehr one (Germany), the combined transport unit tries to benefit from concentration of flows: smaller freight stations are closed and direct trains are privileged when the conditions allow them. So that economy of scale can be realised, and reliability and transit time of rail service can be improved. Rail industry attempts also to diversify its activity, to develop international markets, and the co-operation with forwarders is still under analysis.
The new strategy of Kombiverkehr is also an interesting example of changes in market strategy: Kombiverkehr has concentrated its supply between major terminals in Germany, closing down smaller terminals. After an important loss in traffic volume, due to the closure of the small terminals traffic is growing at a high rate with a much more reliable and efficient operating system (block trains). Co-operation at international level is sought: the present level of activity of rail between France and Germany, Netherlands and Germany remains at a very low level, and market growth expectations and potential are very high.

Therefore, the position of the rail mode in the transport market seems to be based on the two fundamental principles:

- To provide a more adapted service to the user (“tailored” service), which means not neglecting the traditional customer of rail.
- To benefit more from the advantage of the rail production techniques: in particular the more frequent use of block trains as compared to single wagon load technique.

But small companies remain a limited market for rail, and the problem of consolidation of small shipments is still a difficult technical problem to solve in order to provide a competitive offer as compared to road. The international market is seen as a very promising market but rail supply still needs to be adapted to it and this is confirmed as a major challenge for rail in the years to come.

2.2. Segmentation of Road Production Process at a European Scale

Road has many times been characterised as the most efficient, flexible and cheap mode.

The segmentation proposed in the Workshop has been argued and prioritised the “road production process”, seen as an industrial process including social conditions of production.
It can be characterised by the following steps:

- First: differentiation between network operations and truck operations. In the first group the road operator provides a “network” services by contrast with the second group who is most of the time, a small company trying to make the best use of the trucks.

- Second differentiation comes from technical constraints. For examples: chemical products, refrigerated goods, liquid bulk for which technical constraints are imposed.

The next element relates to major characteristics of the evolution in transport.

- Third dimension is linked to the trend of logistics distribution with more significance given to the location of warehouses and with the increase in the integration process within supply chain logistics. Subsequently, road traction is completely submit to the more general management of the flows: information technologies (tracking and tracing technique) reinforce the tendency and influence also the conditions of small hauliers production.

- The fourth modification of characteristics comes from the decrease in shipment size and from the new tensions introduced by “just in time” production constraints. To face this evolution, road supply has diversified the services from full load truck to less than full load truck, from parcel services to unitised transport (for example transport of pallets).

Different operating systems are implemented to satisfy this evolution of demand, supplied by large companies and small hauliers. The borderlines are difficult to identify clearly and systems sometimes compete and overlap.
(a) Small Shipments are under the Influence of Large Operators Strategies.

Integrators, post companies, mail companies and parcel companies develop their own strategies. Historically the organisation of transport for parcels and small shipments differed from one country to another. For example, in France pallets were used as a unit for transport but this is not the case in Germany, making it more difficult to create of European networks. Operators coming from air freight industry have benefited from the situation.

Nowadays, small parcels treatments can be fully automated and pallets use requires human intervention and handling. Large integrators are developed in parallel with more traditional parcel services, supplied by large road hauliers.

In the general trend shipment size decreases. Differences remain important between small parcel with an average weight of 5 to 6kg (up to 30kg in the supply definition) and bigger parcels transport organisation from 100 up to 400kg or even 600 to 800kg with also different standards from one country to another and a diversification of the service according to the transit time (<12 hours, D+1, <48 hours…)

(b) Truck Load Segment

This segment does not require specific handling or transhipment equipment. It concerns semi-products and final products for short and long distances. The destination is an industry (interplant transport) or a distributor. This is the main segment of road transport with a turnover estimated at 100 billions francs in France, compared to 40 billions for the small shipment; in tons and tons/km its share is clearly much more important.

The service is very much standardised with a sole major differentiation due to the shipment volume, having an influence on the type of truck used: with huge semi-trailer up to 100m³. A standardisation is also seen in high volume transport. Before small road haulier companies almost exclusively served this segment: larger road hauliers subcontracted road traction to small road haulier. But larger
groups have entered it with success in the last ten years: an important process of industrialisation and modernisation of the production of services is at works (in France Dentressangle and Giraud companies are good examples and comparison with the evolution occurred in Spain or Germany is interesting) The push toward new social regulations (contract and progress) is a factor for modernisation and the use of modern information technology in the operating system.

The full load truck objective is a strong incentive to determine the shipment size. Shipment size is not completely, a priori, predetermined and depends partly on the conditions of transport chosen. That’s why the shipment size distribution is mainly concentrated around twenty or twenty four tons.

Nevertheless in many case, hauliers have often to complete their truck operators with a second (or even a third) partial shipment. This was still a direct transport, with the same truck, with few stops for collection and distribution. And the trend is also towards “less than full load trucks” shipments. If the truck stop in a terminal, then the pallet is the load unit but the network is distinct from the parcel network. Only in intra-european markets some overlaps might exist, where shipments size are on average higher than in France (an average from 300kg to 400kg compare to 100kg national market). The consolidation of shipments in terminals or logistic “platform” can be a growing trend with more logistic added value services supplied to the shipper.

This main segment is in rapid transformation due to the production process both at national and European scale where it has been stressed that major differences still exist in the organisation of transports. The future modal equilibrium must take into account these dynamics, influenced by new technologies, new equipment, and service demands on the one side and by new external social and environmental constraints on the other side. From all these aspects road and rail are going to change significantly in the coming years.

- Does This Evolution Imply More Concentration in the Road Sector?
Not necessarily, although some large companies have gained a competitive advantage at European scale benefiting from new technologies and taking advantages of differences in social conditions.

New front lines, created by new logistics demands are also opportunities for the road hauliers. Road haulage will probably not be the main structuring activity and road companies have become aware that they must diversify their services in the domain of logistics if they do not want to be limited to road haulage subcontracts. But such awareness does not mean either that large road companies intend to get rid of their trucks fleets to subcontract to smaller road hauliers: contrary to parcels services when large European restructuring has been going on in the recent year, the “truck load segment”, as defined in this paragraph, is still very open along lines which have not very much been investigated within a research project. From this point of view road “production process” has, too often, been ignored or interpreted in a too superficial way, not taking into account social and economic conditions of production process.

- Are these Trends favouring more Transfers on Combined Transport Techniques?

So far they are mostly indifferent to combined transport. The opportunities have concerned more long distances: some examples prove it including the direct use of swap bodies to collect and distribute less than truck load shipment in order to avoid a operation which would have to be added to a transhipment operator in a combined transport terminal. But most of the road hauliers of this segment do not really think of using combined transport, because they do not feel its benefit it and because the quality of service provided is not sufficient for long haul. Nevertheless, some times the road haulier is committed to develop a strategy of combined transport, then rail services provided has to be improved in reliability.
2.3. The Integration of Short Sea Shipping and Ports Activities in the Maritime Transport Chain

Short sea shipping and port activities are clearly internalised in the maritime transport chain. The quality of services provided and competitive conditions are especially dependant on their efficient integration.

**(a) Short sea shipping**

Short sea shipping is by definition part of the multileg transport and cannot be considered in itself as a transport segment. Therefore short sea shipping has been positioned as regards different type of transport organisation.

*Definition of short sea shipping is then difficult: between trans-asian and trans-atlantic maritime transport and inland transport?*

The Commission has also hesitated for a long time to give a precise definition although it appeared as an important domain for common transport policy.

The pragmatic approach of the Think-up Workshop does characterise more precisely the different segments of this market as regards a more global segmentation of transport chains. And the presentation related to maritime transport have focussed on this aspect of characterisation of short sea shipping in the transport market.

At the two extremities of short sea shipping, one can differentiate ferry transport or captive services to islands and feedering which is part of the intercontinental maritime transport:

- On the one side, Short Sea shipping can be considered very closed to road transport (ferry) with transport of truck and trailers (captive transport).
- On the other side short sea shipping depends for most of the part on the intermodal, intercontinental, transport chain but can enter into competition with a road or a rail land leg of the transport chain.
Starting from this positioning the segmentation of the transport chains relevant for short sea shipping activity can be developed along different dimensions.

- Types of operators: many operators are involved with maritime operators to port operators, land transport and logistics operators. Then, the main question concerns the efficient co-ordination between these operators.

- Ships types: Ro-Ro and Lo-Lo with mixed vessels (passengers and freight) for the services to the island or for ferry services. New fast ferries are entering into the markets. Then, the question is to assess if technologies can help short sea shipping to compete with land road transport (when such an alternative solution exist). However it has been stressed that so far, most existing services were not able to compete without public subsidies.

- Geographic zones: in short sea shipping analysis, the geographic and historic factors remain very important elements of dissemination due to their influence on the transport organisation and the geographic competition. (Conditions between inland and maritime alternatives.)

A distinction was made between 4 zones:

**Baltic Zone**: Short Sea shipping is already well developed in the zone with modern and efficient equipment. Maritime routes have for a long time dominated inland transport with shorter distances. In intercontinental traffic, the Baltic zone is a feedering zone for the ports of Northern Europe, providing of Short Sea organisation and best practices.

**Atlantic zone** is dominated by relation between Portugal, North West of Spain and South, the UK and Ireland in the North. Few short sea shipping lines have been developed in this area. Public authorities between Atlantic regions with in the middle of French regions have promoted sometimes lines. But difficulties remain to compete against an increasing road transport between
Northern and Southern Europe, although a ferry leg is necessary to reach Ireland or the UK.

**North Sea zone** has been for a long time a very dense area of maritime short sea services mainly between the East cost of the UK and Benelux ports for all sorts of maritime traffic: Lo-Lo, Ro-Ro, feeding and maritime traffic ferries. For part of these relations the channel tunnel has provided new competition which is mainly concentrated as the channel strait, but which attain up to 50% of the traffic where directly concerned.

**Mediterranean zone** can be split into several maritime areas for Short Sea Shipping with important distinctions and competition with inland routes. In the Helsinki conference when the concept of PETRA (Priority European Transport Areas) was introduced, complementing the TEN networks and priority corridors, the Mediterranean was split into three transport areas: l’Adriatic corridor: international short sea shipping corridor and an alternative route across the Balkans, the Aegean zone between Greece and Turkey, and the Western part of the Mediterranean. Nevertheless, for the two last areas the geographic coverage and the transport relations concerned had to be precise in the light of the opening of Europe to the Mediterranean zone. The INFRAMED project was a first step in this direction for the western Mediterranean part.

Important technology changes and organisational changes are introduced into short sea shipping. The new technologies are developed in:

- Transhipment operation, between maritime transport and inland transport but also between “mother” vessels and “feeders” for intercontinental transport.
- High speed vessels.
New organisational schemes are set up between maritime companies and intermodal operators in order to improve integration of the chains.

Harmonisation of technical standards is however an important prerequisite for the success of the development of technologies and integration of chains. From this point of view Short Sea Shipping is lagging behind inland transport and intercontinental transport. The lack of harmonisation including for load unit certainly hampers the development of Short Sea Shipping. Load unit varies considerably from one country to another, from one line to another, from one operator to another without clear maritime justification nor inland transport or transhipment logistics advantages.

The harmonisation work is required from a technical and also a social point of view, although this is far from being a reality. This is partly explained by the fact that short sea shipping is the last transport sector introduced within the Common Transport Policy (CTP) and the most transport measures have to be agreed upon with new members countries in Scandinavian and many “third” countries in the South.

A first segmentation of Short Sea Shipping, which prioritised transport chain integration, would include at least four different components (short sea shipping which is sometimes very close to a road transport):

- Feeder services as part of an intercontinental maritime transport
- Bulk transport (petroleum products, minerals, foods for animals, chemical basic products) which has been for a long time a traditional national and international Short Sea Shipping market.
- General cargo, competing against inland road or rail transport and which must be sometimes further differentiated according to the technics used on the geographic zone (for example Lo-Lo and Ro-Ro technics)
- Integration of ports operators
(b) Port Activities

The segmentation of port activities are also characterised as regards the chain integration:

Taking the example of Italy peninsula, where Short Sea Shipping has been historically very much developed in comparison to other European countries (at the exception of Nordic countries), the development of maritime containers traffic has been a major subject over the past years. But Italy is also a country with 39 sea ports connecting with 19 countries where inland access to the ports are very difficult contrary to northern countries: the ports of hinterland are most of the time the port region. The market is a regional market when transhipment activities are excluded as it is the case for Goia Tauro traffic: in Goia Tauro inland the traffic represents only 20000TEU out of more than 2 millions TEU handled.

In the case of Genova, a port with also a very impressive activity growth over the last five years, the inland transport rarely exceed 300 km, to reach the towns of Milan and Padova. Direct access to the port area is also very difficult, within urban or dense area. All road accessing the port of Geneva are congested with a density of traffic close to 60000 vehicles per day and 10000 trucks. Many Mediterranean ports extensions are face major urban problems. Usually, the towns have been developed around the original port location and new locations outside the urban areas become very difficult to find. An exception is Marseilles where this has been possible. Consequently the ports did not have the necessary parking area. Studies realised stressed the difference between the Adriatic market (mainly international market) and the Tyreman market (mainly national market).

Then, difficulties exist to promote short sea shipping, although the potential market might appear very important. The analysis of transport figures is a good indicator: road transport in Italy, for distance over 500 km, is 71 millions tons and short sea shipping for Ro-Ro and Lo-Lo probably do not exceed 6 millions tons, less than 10% of the traffic with many links parallel to the coast line.

The major problems identified are:
- conflicts with urban and port development;
- priority given to passenger transport with high traffic peaks with summer activities;
- lack of parking spaces which is related to the first type of problem.

From this analysis it appears that the Short Sea Shipping segment, which are in competition with road, will remain fairly marginal for the coming year although road transport should manage with difficulties and congestion problems. The complexity of the Short Sea Shipping chain, the necessary urban adaptation are such that a significant change can only result from a long term comprehensive approach to the problem. A first phase might be to launch public new services towards transport companies and shippers.

2.4. A Search for Complementary or Substitution of Air Freight Transport

Air freight transport is growing very fast in the world and is reaching now 28 millions tons, 80% of international transport. European airports volume is 10 Millions tons, with 50% in the 4 main airports: Frankfurt, London, Amsterdam and Paris.

From 1991 to 1999 the world economic growth was 20%; the air freight growth was three times higher, 60% in tons (and at least 80% in tons-kms); the annual rate of growth is 6 to 7% and up to 15% for express freight. Therefore the volume in tons becomes now very significant although most of the products transported by air are very high value products with low density; the relative importance of air freight in value in international transport is much higher than in tons and reaches 10 to 20% and even more in developed countries; but it remains difficult to produce precise figures.

A first, almost obvious, segmentation for air operators is the distinction between general cargo and express transport:

- Air express freight is only 7% of the tonnage with world but already 50% of air freight in the United States. But now integrators are associated with major
mail companies, so that air express is expected to reach 40% of air freight by 2020 in the world-wide: French post associated with Fedex, Dutch post with TNT, German post with DITL.

- The general cargo segment is quite a different segment: traditional air companies operate with 60% of the freight transported in passengers’ airplanes. (Only 40% of the general cargo is transported in dedicated freight planes.) Within European boundaries most of the air freight is transported by trucks (80%).

To face the traffic growth, in a congested European airspace, more and more air slots are required. Logistic plans are also required closed to the airports where pressure for land-use is already very strong. But a possible problem is that take-off and landing will not be accepted by residents living nearby.

Some operators and local authorities have sometimes tried to develop new airports for freight in more isolated place, and to create opportunities for new air hubs dedicated to freight: but often these attempts have not been successful and new activities were not really attracted. The freight airport must also be a real logistic mode and intermodal links will become more and more important and a good perspective.

Therefore, a perspective for air freight in Europe is to develop as much as possible intermodal solution so that more flexibility is introduced into the use of the airports in particular over the dense areas of Northern Europe. But in such strategies a missing link is often the rail connection. Therefore, high speed train connections with airports have been envisaged, but some technical problems remain to be solved:

- Solutions for transhipment are not yet defined
- High-speed new wagon characteristics have to be defined.
Thus two types of organisation have to be studied:

- a more conventional solution with train running at 160km/h on the same tracks as the passengers train.
- a high speed train solution which raises more technical problems

It is clear that large operators are trying to develop new strategies under the constraints of space allocation and slots allocation and that they are thinking more and more in terms of networking the airports and not only in terms of diffusion of traffic from different airports.

2.5. **Conclusion for segmentation from an Operator Side**

At the end of the “operator” point of view session an attempt of segmentation has been made. It appears that the segmentation of the market for the operator is very wide open. The operator has a long-term approach (a strategy) and is at the same time very sensitive to the general context of the transport market, including the political context.

Therefore the segmentation of the market appears through different “layers” or dimensions, which are not independent: technical, economical, strategic and political dimensions characterised by:

- Technical constraints of shipment: products characteristics, shipment size and conditioning of the product
- The production process of the transport (in close relation to the shipment size and the spatial coverage of the market), which includes use of information systems, automatisation technics and social aspects; intermodal transport, facing the problem integrating different legs of the transport chain, could be introduced at this level.
• The definition of a strategy for the firm, which relates to short and long term commercial policy: from this respect, segmentation itself is an element of the strategy.

• The existence of a social demand and policy context towards sustainable development; this context differs from local or regional level to national or European level and influence the operator projection analysis of the transport market: solutions which are more friendly to the environment will be favoured. They might become more and more compulsory as it appears for urban logistics or to cross sensible zones.
3. “Cross-Segmentation and Trends in Freight Transport Markets”

After the two first workshops focussing on users’s and service providers’ point of view a first attempt has been made for a cross segmentation. On this basis, contributions were presented to put this segmentation into perspective and describe the possible influence of different factors on the segmentations.

To achieve the cross-segmentation, the figure of 15 to 20 segments has been proposed as a first order of magnitude and a manageable number of segments. For a dynamic approach, the cross-segmentation must be defined in a medium and long-term perspective, in order to predict the fluctuation in the number of segments. For this, transport trends are taken into account as well as changes in logistic organisation and possible impacts of new techniques and new technologies.

A hierarchical organisation of the segmentation process could be also very useful, so that more details can always be given without affecting the clarity of the process.

The main factors of the segmentation retained are the following:

3.1. A first basis for cross segmentation

1) First the necessity to isolate some *bulk products* has been highlighted.

Bulk products have been analysed as specific logistic chains: petroleum products, coal, iron ores, minerals, cereals…. Nevertheless, for the moment the level of detailed of this list has not been decided. Does it necessary to introduce wood, paper pulp, fertilisers….? Most of these products are transported in bulk; but sometimes the conditioning changes; fertilisers are more concentrated than other products; some cereals are put in containers and so on.
2) At the opposite of the bulk transport, the delivery of parcels and in particular the delivery in urban area appears. This subject becomes more and more important for policy makers at local levels. Urban logistics is now a major topic of urban transport with specific constraints imposed as regards the routes, the vehicles, the hours of transport. They are also necessary to improve urban transport planning which is part of land use policy. In this case, rules for modal choices are quite different than for interregional or international transport. Urban transport requires sometimes the implementation of new warehouses or terminals to collect and to distribute goods in dense areas, having on turn an influence on the consolidation process of the flows and on long distance modal choice.

Because of this specific institutional context, and because of these transport requirements, *urban logistics* have been proposed as a specific segment.

3) Between these two extremes, remains a wide range of transports, mainly transport of *general cargo* on medium and long distances.

The transport of general cargo can be considered a priori as a “potential” market for intermodal transport, when distances are not too short, above 300 to 500km (to give an order of magnitude). For this reason, a work in depth of cross-segmentation for intermodal transport has been prepared. Possible sequence of variables will be investigated and defined according to different possible factors such as: the type of shipment (long as shorter distances), the type of companies (industrial shipper, transport operator, small and medium enterprise) or technical constraints (perishable good, hazardous goods).

This question of segmentation per type of products, per shipment size, type of enterprises has been concretely raised in the studies done for transalpine traffic. The solution adopted, in order to find the best compromise, has been presented as a relevant illustration of the problem.
An other important question raised was to decide whether the type of enterprise should prevail over a spatial segmentation, which privileged the difference between regional and interregional transport.

4) At this stage of the analysis, a new dimension appears the transport policy.

The policy tools influencing market choices are often limited. Nevertheless it is important to know how pricing and public investments influence the transport organisation and modal choices. Results of simulation done in Germany are reported.

5) Finally, the modelling constraints could not be ignored.

The choice of segmentation can be neither predefined by the constraints of the existing models. But statistics constraints strongly influence the existing models, and do not always reflect the worst relevant characteristics of evolution. So an equilibrium had to be found between the relevance of the segmentation as regard the transport market and the objective of evaluation of trends of the transport segments.

In the Naples Workshop, the cross-segmentation proposal has been tested as regard potentialities of models to assess the trends and their influences on the final proposal.

As pointed in the contribution of IWW (Werner Rothengatter, Eckhard Szimba) there is much dynamics in the freight transport market, not only on the demand side, but also on the supply side. Demand structures of the freight market have been changing significantly. Companies have had to cope with increasing competitive pressure generated by the globalisation of markets and have had to realise cost savings potentials by applying advanced production technologies. The application of advanced, computer-aided production technologies results in a higher flexibility of production, which demands for a higher flexibility of freight transport providers as well. The new demand structures (smaller consignments;
quick, reliable, direct transport; etc.) have been generating an increase in vehicle mileage and have a high affinity to the mode road.

On the other hand, the changes on the supply side, namely the introduction of distance-related road charges, will increase the costs for freight transport on the road and may help to shift at least a share of the growth in freight transport to other modes. However, it cannot be expected that the introduction of moderate road charges for heavy goods vehicles will result in sudden behavioural changes on the demand side. Companies are in many cases “captives” to logistical structures, which is due to the fact that the production technology applied considerably determines the demand structure for transport services. Decisions about production technologies and the establishment of logistical systems are long-term decisions, which cannot be altered easily.

Nevertheless, there are opportunities for freight transport by rail, which arise both from the demand side and from the supply side. With the paces towards European integration the transport distances have been increasing, and long-distance freight transport is a core market segment for the rail mode. European integration will help to overcome the border obstacles and to enable international rail alliances. Making more use of Information and Communication Technologies in rail freight transport, e.g. for a complete monitoring of goods being carried or for bundling small consignments, will be an adequate measure to strengthen the competitiveness of the rail mode. On the supply side the approaches for new ways of transport infrastructure funding will enable an equal treatment of the modes rail and road and finish the privilege for road freight vehicles not to pay an adequate price for their asset depreciation.

3.2. The Spatial Dimension as an Instrument of Policy Decision

Such analysis was not possible, until origin/destination flows information on a regional basis became available through the NEAC European simulation system.
Diversification of reactions by region to policy measures makes possible to develop a segmentation of situations according to spatial characteristics into 3 levels:

- Market oriented (high elasticity to policy decision)
- Neutral
- Structures are captive (inelasticity to policy decision)

When two different territorial units have a similar level of access to a specific transport mode and a similar propensity in generating and attracting flows for a specific segment of the market, it is expected that they show a similar modal share of inter-regional transport flows. The observed differences should refer to variations of logistic conditions, local specifications, and last but not least the perception of service/market combinations by the shipper or the operator.

The calibrated model considers the current performance of a mode of transport in a region as a function of various demand and supply elements. But instead of spending efforts to measure in a reliable way – and that is the main obstacle – the values of those variables, we consider the differences of performance between regions as a function of these variables, at least of the extent they intervene in the choice process.

For example spatial dimension is measured through the performance of rail as an alternative mode on those relations where rail is already observed. The estimated model attempts to find a function between the performance of rail as an alternative mode to road and the differences between regional characteristics as expressed in the introduction. Considering the segment of O/D relations where rail is observed, a model has been computed which expresses the performance of rail transport as follows:

- performance: rail tonnage per origin x destination
- explanatory variables: total demand of transport on the relation, generalised costs
The result is a segmentation of O/D relations and by extent the regions, between those which have already reached their “optimum” and those for which potentials of transferring road exist.

The spatial approach of mode performance might be extended to each mode of transport and segments of goods. In addition one can use a similar spatial approach on the local level in order to take account of specific differences in the economic tissue and the logistic services. Assume the policy chosen results in the construction of a network of intermodal stations in a given region. The question arises how to distribute the investments in the existing situation. By building up a spatial distribution model which is fed by the differences observed in the current situation, one could create a network of shadows stations and calculate the optimal distribution of logistic services. This method has been successfully tested in case of a network of inland waterway terminals.

The approach, which has been described and to some extent tested, illustrates an innovative path for policy decision, which uses the spatial dimension to rank and modulate policy decisions according to local specificities. Assuming that those variables, which explain the local aspects, are difficult to estimate, one uses the differences of performance in transport to adapt the policy implementation and relative the risks. By using aggregated models one can estimate the effect of policies in average, and then calculate at the regional level which effect this will have. The spatial segmentation will result in regions which are elastic to policy decision (and little local policy is needed) and those which necessitate a strong intervention of local and national measures.

3.3. Cross-segmentation of Intermodal Transportation considered as one Mode

The segmentation objective can also focus on intermodal market outputs which are the market of transport “units” including maritime ISO containers, swap-bodies and semi-trailers.
To establish this segmentation, have been analysed crucial parameters for the user modal choice and for network technico-operational solutions implemented by the operators to respond and satisfy the demand quality and economic requirements:

- shipment characteristics: shipment size x shipment logistic position
- distance and flow intensity: distance x flow volume and regularity
- time criteria: door-to-door transit time requirement considered as a determining segmentation criteria. Indeed, intermodal transport can be considered as fully competitive considering only the two first segmentation parameters, only the time criteria enables to analyse the potentialities of intermodal transportation on specific markets as FCL/LCL, short distance, low volume corridors.
### Table: Cross-Segmentation, Quality Requirements, Network Applications and Intermodal Competitiveness

<table>
<thead>
<tr>
<th>(15) Segments</th>
<th>Quality Requirements</th>
<th>Network Applications</th>
<th>Intermodal Competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Full through train</td>
<td>Reliability</td>
<td>Block &amp; shuttles</td>
<td>Competitive</td>
</tr>
<tr>
<td>2. FCL/FCL interplant transport (≥ 24 hours)</td>
<td>Reliability</td>
<td>Block &amp; shuttles</td>
<td>Competitive</td>
</tr>
<tr>
<td>3. FCL/FCL production – distribution units</td>
<td>Frequency Reliability</td>
<td>3a &amp; 3b: block &amp; shuttles</td>
<td>3a: potential \ 3b – 3d: competitive</td>
</tr>
<tr>
<td>3a. 12 hours</td>
<td></td>
<td>3c &amp; 3d: all systems except liner trains</td>
<td>3b – 3d: competitive</td>
</tr>
<tr>
<td>3b. 24 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3c. 48 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3d. &gt; 48 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. FCL/FCL &amp; FCL/LCL distribution transport</td>
<td>Reliability Frequency</td>
<td>4a: block &amp; shuttles</td>
<td>4a’: potential \ 4a”: uncompetitive</td>
</tr>
<tr>
<td>4a’. 12 hours FCL</td>
<td></td>
<td>4b: all systems except liner trains</td>
<td>4b: competitive &amp; potential</td>
</tr>
<tr>
<td>4a”. 12 hours LCL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4b. ≥ 24 hours FCL &amp; LCL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. FCL/FCL accompanied transport</td>
<td>Accessibility</td>
<td>Shuttles</td>
<td>Competitive</td>
</tr>
<tr>
<td>6. FCL/FCL unaccompanied transport (≥ 24 hours)</td>
<td>Accessibility Reliability Frequency</td>
<td>All systems</td>
<td>Competitive</td>
</tr>
<tr>
<td>7. FCL/FCL perishable goods</td>
<td>Reliability Accessibility</td>
<td>Block &amp; shuttles</td>
<td>7a: Potential \ 7b: competitive</td>
</tr>
<tr>
<td>7a. 12 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7b. 24 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. FCL/FCL hazardous goods</td>
<td>Security Reliability Accessibility</td>
<td>Block &amp; shuttles</td>
<td>8a: potential \ 8b: competitive &amp; potential</td>
</tr>
<tr>
<td>8a. 12 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8b. ≥ 24 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Following this method, intermodal transport market might be segmented into 15 market segments, from which 14 would be competitive or potential for intermodal transportation.

That means that on 14 segments, through existing and innovative production systems, intermodal transport can meet the user requirements because of the use
optimization of the different modes: intermodal transportation is not defined only by the utilisation of rail, air, short sea shipping or inland waterways but by the combination of these different modes with road haulage to get an economical and qualitative market acceptance. This is not a modal competition market but a partnership process.

3.4. Conclusion of the trend analysis for the cross segmentation:

To achieve this objective first principle is that, when possible, some hierarchy in the segmentation variables can be stressed (so that, according to the detail of the analysis more or less segments can be identified), in a global approach which will remain consistent: in others words segments can be tested or embedded.

Some «invariants» of the problem have to be stressed:

- *Space* is a first “invariant” which should be introduced at some stage of the cross-segmentation.
  
  Local or urban space has already been selected as a major characteristic of a specific segment in the former Workshop.

Now regional space appears as an interesting cross-segmentation variable:

- because the region is a consolidate and distribution zone for long distance shipment, regional warehouses, platforms structures and transport chains;
- the region is a statistical unit (Nuts 2) used in transport analysis and modelling. SCENES and SMILE models use the regional zone to introduce the attraction of region for implementation of warehouse;
- finally the region is also for further analysis a relevant unit to show the differentiation of modal split according to geographic characteristics or difference in transport organisation, as shown in NEA intervention.

- The *types of products* are a second “invariant” in the case of the first differentiation done for bulk products. The types of products transported
reflect a pattern of distribution, of production and consumption location. This is the starting point of SCENES model.

At this point of the segmentation, more details could be given to the types of products:
For example, in the SCENES model, agricultural products and chemicals products have been well distinguished. These types of products require specific transport conditioning and sometimes obey to particular transport regulations. Therefore it was decided to identify within these products the perishable goods and the dangerous goods. But the differentiation is only possible when the nomenclature refers back to an economic nomenclature, as done in SCENES model for the estimation of hard flows, and not to the NSTR nomenclature (at one or two digits level). The NSTR nomenclature does not make a good division between bulk agricultural product and foods, or between bulk chemical products and chemical manufactured products, which are dangerous products. Therefore a distinction between chemical products can be made between bulk (which can also be dangerous) and dangerous products. To proceed with this analysis, the O/D matrice in volume of SCENES model will be used.

- By contrast, the type of enterprises (large companies and SME, industries or distributors), a privileged variable at the first stage of the segmentation, does not appear as an “invariant”:
  - Most of the time, the forwarder or the transport organism chooses the transport mode and less and less often the industrialist: SME often require the service of a transport organism for long haul transport and large industries outsource this kind of service.
  - The interplant transport (B to B) is certainly an important segment to identify because the changes are going faster with the multiplication of intermediate value added operation in different location. But available statistics concern only the type of shipment, and not the type of companies. Therefore, to follow this type of structural changes in the production and spatial pattern, only rough approximation can be made, through the types of products (intermediate or
final goods), and through a differentiation between interregional and regional flows. Only specific shipper surveys available (France…) give a more precise understanding and help for general comments of these impacts on transport distances and on, what is called, the “handling” factor.

- The supply transport variables are certainly very important variables for the modal choice.
  But the quality of service provided is also appreciated as regard the *shipment size* which is a demand variable. For different shipment size, different transport production processes exist for road, rail, and inland waterways.

  For small shipment, a consolidation process is essential, consolidation for a full load truck or consolidation for a direct train.

Nevertheless, shipment size, which has been stressed as a major variable, is not available in existing statistics. Therefore proxies must be used:
- Value of the product per ton is one possible proxy.
- An other possibility is to consider if the consolidation process is a truck or a train or a barge and occur at regional level. In this case, the interregional flows are consolidated flows. But for trains, this situation seems very difficult. One possibility could be through hubs (and marshalling yard) of the interregional network. But the problem of efficiency becomes a problem of adequate implementation of hubs according to the interregional flows pattern: the major differentiation is then between conventional trains and intermodal trains since bulk trains are most of the time direct trains.

Therefore, the cross-segmentation as regards shipment size and type of production process, which is often at the heart of transport competitiveness, is very difficult to tackle in a straightforward way. One solution would be to stress on the difference of the trends according to shipment sizes. But this can only be done indirectly, by reference to available specific studies or surveys. Therefore it introduction in the sequence of segmentation variable as such, seems difficult.
Concerning others variables of transport quality reflecting the demand requirements and transport quality of service, which answer to this demand (price, time, reliability, flexibility…), their introduction could be done when a deeper analysis of the core/competitive position of the modes will be discussed. They will be integrated inside a wider segment of the cross-segmentation, at a later stage of the analysis. The scale of segmentation does not mean that quality variables are secondary variables. On the contrary, they are very important for modal shift. But these transport characteristics are not really considered as we have called “invariant”, since the objective is also to assess policy which can influence the present, the modal share observed within the cross-segments.

Once arrived at this stage of the cross-segmentation, changes in technologies and changes in transport policy can be analysed in order to understand better under which conditions the modal shift evolves. At that stage only, the sensitivity tests, relative to prices, tariffs, and taxes, can be done as shown in the intervention of IWW.
4. Evolution of Segmentation of Freight Markets

After the meeting in Naples, the Seminar, held in Berlin, developed a last step in the segmentation analysis of the freight transport market as regards THINK-UP objectives: the objective was to give a dynamic perspective of the cross segmentation so that the analysis will remain relevant for medium and long term scenarios.

Taking for basis the segmentation results of Naples, the aim was in this step to test the segmentation in a prospective way to identify changes in modal split in order to test the influence of the evolution of these external factors on the modal split: evolution in logistics and technology, implementation of policy.

The introduction of the prospective dimension could lead to define broader segments giving more flexibility to the segmentation in order to take into account these changes. In fact, the hierarchisation of segmentation variables gave also flexibility in the segmentation analysis since it is always possible to integrate more or less details in the analysis.

Since the final objective is also to provide a segmentation to the modelling team of EXPEDITE three comments have been added to that:

- First: the freight segmentation will always differ from the passenger segmentation. The decision process and the object of decision are quite different. Nevertheless, considerations about spatial dimension appear to be very important in both segmentation. The spatial dimension brings more consistency in the overall approach in particular when network assignment will be done, or problems of congestion tackled.

- Secondly: freight models are less advanced than passengers models. One of the reason could probably be that freight models are more dependant upon external factors, in particular upon logistics factors of industry
sectors and distribution sectors. (This has been a major topic of the Berlin discussion.)

- Thirdly: the THINK-UP segmentation is not fully constrained by modelling operation. In freight, particularly no new model will be available to estimate the trends. By contrast of passenger, for which a combination of a meta-model for short distance and of a network model (SCENES) is envisaged. SCENES results will be used for freight, probably in parallel with the use of existing results of other models. The segmentation analysis will then always be useful for qualitative comments and seems relevant to existing models structures.

Within the context of the evolution of the THINK-UP segmentation, the different interventions have been prepared and presented during the final Seminar:

- on changes in logistics (V.Gacogne, INRETS);
- on the possible impact of policy measures on the different freight segments (D.Tsamboulas, NTUA);
- On the possible evolution of rail operating system with a specific on single load wagon (for conventional and intermodal transport) which seems to be a very critical point of the future of rail supply (B.Kortschak);
- on the results of Finnish freight model used in Scandinavian countries (B.Silverfberg, Lt Consultants Ltd);
- on the market shares of the different transport modes and their network cost elasticities (M.Beuthe, FUCAM)

4.1. Trends of Logistical Systems and Changes in Segmentation

At the present time, we are facing in Europe and more generally at a global level, some profound reorganisations of the production, distribution and transportation systems. We will try to briefly explain some of these trends by focusing on the structural changes of the production and distribution networks made by shippers
in order to understand how they can affect their demand for freight transport. Then we will discuss if these organisational changes entail a streamlining of interregional freight flows, and how they can concern railways services and especially wagon load which appears as an important issue for the future of railways operators. In other words, how could the services of railways operators evolve to meet shippers’ requirements and eventually to take advantage of possible changes in demand due to these reorganisations?

We will look at these changes coming from the decisions of the manufacturers but only of intermediate and finished products. Bulk products have always accounted for a significant part of rail modal share thanks to train load from point to point, and so they are not of our main concerns here. We will look at changes resulting from the short-term and long-term decisions which can affect the distribution organisation and its network or also the production organisation. However this will not be an exhaustive summary of all the trends observed in the production and distribution systems, but a brief presentation of current changes which can directly affect the structure of freight demand.

Distribution includes a certain number of operations from the production site to the final customer such as storage, carriage of goods etc. In fact, we can distinguish on the one hand decisions which will determine the organisation of transport between two distribution levels. These short-term decisions are influenced by trade-offs between transport, inventory carrying costs, order costs and also by the quality of service required. They are of tactical concern and mostly affect quantities i.e. the size and the frequency of shipments and the stock level. An optimum has to be found between these costs taking into account the characteristics of the product and the quality requirements to be met.

From the decisions which affect the transportation organisation between two distribution levels, we can mention the following trends:
(These points are general trends since decisions depend on multiple parameters in particular those linked to the type of product - logistics is a complex system)
• the generalisation of the well-known just-in-time practices which lead to smaller and more frequent shipments;

• furthermore since these practices reduce stocks, just-in-time implies higher quality requirements which may be more important for intermediate products, because they can face tight industrial supply chain constraints (as a delay can disrupt a production process). These quality requirements can be for instance reliability and flexibility;

• in addition, these trends are increased by the development of information systems which speed up the information flows and make them more reliable;

• at last these statements can let us expect a possible increase in the use of light duty vehicles, especially if heavy duty vehicles are affected by a significant increase in costs (for instance due to a rise in taxes).

Then on the other hand, we have to consider strategic decisions which will influence the number and the geographical situation of the distribution centres which can be either warehouses, depots or platforms. They lead to more or less centralised distribution structures, that is to say structures with more or less distribution levels.

• At present, it is generally admitted that firms move towards more centralised distribution structures cutting out intermediate levels. This is the first and the most important trend.

These centralised structures allow economies of scale since they reduce warehousing costs (which depend on the number of distribution centres) and inventory carrying costs. This evolution towards a European approach of the logistical system was made possible thanks to the removal of trade barriers, better infrastructure, more efficient information systems, and lower transport costs (due
to deregulation and better productivity) etc. These changes imply that pan-European warehouses will be preferred to national warehouses, and local depots near consumer markets could be replaced by platforms for consolidation / deconsolidation and the storage of high turn rate products. This general trend, which also depends on the characteristics of the product, leads to longer distances and more international transport flows.

• Secondly the increase in the involvement of third-party logistics service providers can help streamlining and consolidating flows.

• Last, we have to mention the current concentration of the wholesale distribution which urges large firms to supply important good quantities with an efficient organisation.

The emerging b-to-c commerce is not mentioned herein as it is too early to analyse its possible effects on distribution networks, and it goes beyond the scope of our presentation.

We have seen that there exists flexibility in the organisation of the logistical system to be considered independently to the industrial production context. This flexibility is linked to cost and quality criteria. Then moving on to the production organisation, we can summarise the general trends as the following:

• Development of the sub-contracting of intermediate stages of the production process adds links to the industrial production system, and therefore increases product movements. However it seems that in parallel, large firms reduce the number of their suppliers.

• An increase in the concentration of the production with a reduction in the number of plants leading to a rise in the average distances of transport;
• Increased specialised production units dedicated to pan-European regions instead of multi-product plants dedicated to national/local markets;

These last two points are sometimes mentioned as current trends and obviously make part of the strategy of large international firms, but nothing yet can support these statements as general trends.

• Relocation of production units when a high rate of workforce is required but not a high level of skills.

We are not forgetting the increasing number of mergers, company investments in their core business withdrawing from some other activities etc. Obviously these trends form part of the firms' global strategy, however they are of financial concern, and are therefore not relevant here.

4.2. Impact of the Transport Policy on Transport Modes Freight Share

Modal share in freight transport is dealt usually through statistical analysis and simple trends analysis for forecasting or modelling, the latter based on principles developed mainly for passenger transport. On the other hand, research (LOGIQ Research Project, 1998) has shown that modelling of freight transport share is not an easy process, since the Decision maker is not a single individual, but it involves a decision making process at the firm level (Daly, 1982; Tsamboulas and Kapros, 2000). Thus, a need for another approach is arisen. This presentation outlines such an approach, at a qualitative level, which disaggregates the impacts of the different European transport policies on modal shares by freight transport market segment.

Changes in modal shares could be the result of external to transport factors and policies as well as transport related ones. There is evidence that modal share in freight transport is affected by external policies to the transport sector (Rothengatter and Szimba, 2001). They have identified the following factors:
1. **Changes in the commodity structure**: "emerging commodities", like vehicles, machines, manufactures, semi-manufactures, Food and animal food, chemical goods have gained importance and others like coal, iron, steel, non-ferrous metals, metalliferous ores and metal scrap have lost relative importance.

2. **European integration/ globalisation (macro-policies’ dimension)**: macro-policies and the related companies policies have a profound and more lasting effect on transport modal share for freight transport. This is due to the decisions taken as a result of these changes that are usually long lasting and they are not immediately affected by policies targeted to transport sector only. Globalisation and European integration results in a spatial extension of trade. More goods are exported/-imported in/ from countries, which are far away, so that the average distance of imported and exported goods is likely to increase. In addition, Globalisation and European integration implies changes in the procurement and distribution management of companies, because increasing competitive pressure and the opportunity to realise cost savings however, have encouraged a more international oriented procurement policy.

3. **Changes in production technologies (companies policies’ dimension)**: it is taken place with the application of advanced production technologies and mainly by the application of flexible manufacturing systems (FMSs), which is closely connected with the term “factory of the future”(Crama, 1996). They have been being driven by the requirement to cope with increasing competitive pressure and to gain from cost savings potentials and the need to enhance the flexibility of the production. The application of advanced production technologies has been enabled by achievements in the field of information and communication technology.

The requirements for freight transport resulting from the three main trends are strongly in favour of the road mode. However, increasing distances of carriages
favours maritime transport for containers and Short-Sae-Shipping, and it could provide some opportunities for the rail mode, if the appropriate services are provided.

The main objectives of the transport policies are:

- Improving quality by developing integrated transport systems based on advanced technologies which also contribute to environmental and safety objectives;

- Improving the functioning of the single market in order to promote efficiency, choice and user-friendly provision of transport services while safeguarding social standards;

- Broadening the external dimension by improving transport links between the European Union and third countries and promoting the access of EU operators to transport markets in other parts of the world.
5. Conclusions and consolidation of the cross-segmentation

For conclusion of the presentations and the debates few points have been highlighted:

1) *Changes in logistics analysis revealed two different aspects:*

   - Changes in industrial logistics privilege a sectorial approach and a desegregation per type of products. Then, the segmentation per type of products seems more adapted.

   - Changes in distribution logistics privilege spatial aspects with polarisation in specific European zones, with a reorganisation of distribution at European and regional levels, and with also sometimes “proximity” distribution centres for urban logistics planning. This last dimension is fairly well taking into account by the spatial dimension of the segmentation.

At a more detailed level, transport logistics requirements can be introduced with the different conditioning constraints in order to give a more precise understanding of competition between modes for general cargo. But this only happens when the type of product becomes less important as regard the conditioning aspects.

2) *For policy impact analysis, all alternatives modes have to be taken into account* and not only rail mode. Inland waterways and Short Sea Shipping have not to be forgotten.

A policy impact matrix has been proposed. Comments from the participants are expected on this first attempt to assess policy impacts on segments.
3) **The policy implementation (or policy context) cannot be assessed independently of the game of actors, mode operators, and industrialist.**

These actors seek to influence policy actions through lobbying.

At the end of the Seminar, the segmentation has been consolidated with few levels of segmentation variables:

1) **The first level gives a very integrated view of the logistic chain:**

The differentiation between bulk and non-bulk products is reinforced.

The supply chain management is integrated through the different types of bulk products.

For non-bulk products, the segmentation goes on according to other types of variables and among them the shipment size, and the differences between industrial and distribution logistics.

2) **The second level is the spatial dimension.**

On the contrary of the first level, the spatial dimension tends to split the transport chain between different legs, given a very complementary view of the problem: in particular in one transport chain, general transport legs can be combined with different modes. The chain segmentation is different from a segmentation who aims only to explain the importance played by a mode (within a transport chain). The “spatial” variable helps to solve this problem. Competition between modes for one leg of the chain does not mean that modes cannot be complementary. In other words the role of alternatives modes will appear more clearly if the interregional transport is differentiated from regional transport, if O/D relations are identified where maritime transport or inland waterways can provide a competitive offer.

Furthermore regional, interregional distinctions (within the intercontinental and local sub-distinctions) help to understand the problem of consolidation of transport flows: a crucial point for the analysis of competition. For most shipment
size, consolidation of flows between region is necessary, even for truck transport. By this way, for rail mode the problem of shunting the wagons at a regional level (or multi-regional level) is raised, and then the competition by the supply side can be evaluated. Consolidation problems also exist in maritime ports and inland ports.

To summarise, this operative approach is very important to assess competition between modes.

Finally in the consolidation, distribution processes which characterise some bulk transport, the conditioning and “transport” logistics variables become important. Storage, transhipment, type of equipment are determined by these constraints. This allows the subsequent segmentation variables mentioned overthere.
B - SEGMENTATION OF PASSENGER TRANSPORT MARKET
The presentations and discussions of passengers segmentation have tackled among others following spheres:

- Relevant future trends (supply and demand side)
- Modelling, forecasting and understanding passenger transport demand
- Competition between modes
- Segmentation of the passenger transport market

Although transport policy implications were not in the core of the discussions on the THINK-UP events mentioned above, in this paper the contents of THINK-UP Deliverable D6 have been supplemented by policy conclusions to be derived from the presentations and discussions.

With a slight difference as regards freight segmentation, analysis of trends come earlier in the process.
1. Relevant future developments

1.1. Demand side trends

1.1.1. Demographic and societal trends

The most striking development on the demand side is a severe change in the demographic structure of many Western European societies, which can be expected in the next decades (Figure 1). Due to a decrease in birth rates and an increase in life expectancy the share of elderly people will increase considerably. Due to such demographic developments the number of immigrants is expected to rise. However, the moving in of immigrants will most probably not compensate wholly the development in Western European countries.

A tendency towards increasing individualism can be confirmed when regarding the development of the average household size in Western European societies (see Figure 2). There is no reason to put in question that this evolution will continue in the future. Increasing individualisation accompanied by continuously growing household income is likely to generate more transport intensive mobility behaviour patterns.
Source: Data for 1996: SCENES Internet Database, forecasts: EUROSTAT, baseline scenario

Figure 1: Demographic development in some Western European countries

Source: National Statistical Offices
2.2 Evolution of the average household size in different European countries

![Evolution of the average household size in different European countries](image)

**Figure 2: Development of average household size**

**1.1.2. Economic trends**

Due to differences in language, culture and other differences employees in the EU will remain rather immobile, e.g. in comparison with their colleagues in the United States. Thus the production factor “human resource” will remain much less mobile than the factor “capital”. The introduction of the Euro will result in a higher level of convergence of European labour markets, most strikingly in terms of level of wages. Due to the high mobility of investment capital the conditions in labour markets are expected of being linked more to productivity.

With regard to the evolution of economic growth in Europe the highest dynamic is expected in Central European (CE) and Central Eastern European (CEE) countries, while for Western European countries (EU 15 countries and EFTA countries Switzerland and Norway) relatively moderate economic growth rates are forecasted (Figure 3).
Forecasts: Average annual growth rate GDP (1996 - 2020)

Figure 3: GDP growth rates by countries – forecasts generated for the SCENES project
1.2. Supply side trends

1.2.1. Air services

In the air market airline alliances will become even more important. Following effects on service parameters are associated with an increasing importance of airline alliances:

- Improvement in level of service on hub-hub and hub-spoke relations.
- Intra-modal competition is shifted from airlines to alliances. Therefore the number of competitors decreases.
- The role of hubs is strengthened, new “mega hubs” might arise.

When considering the effects of the arising of strategic airline alliances one has to distinguish between alliances, whose members operate complementary networks and those alliances, whose members operate overlapping networks. The formation of strategic alliances, whose members operate complementary networks results in improved level of service, reduction of tariffs and an increase in consumer surplus. Accordingly the effects of alliances, whose members operate overlapping networks, are as follows: reduction in the level of service on parallel lines, the arising of an environment being less competitive, an increase in fares and a decrease in consumer surplus.²

The market for regional air services is considered as an emerging market. Even connections between regional airports are mainly operated through hubs of regional carriers. Hubs of regional carriers are usually smaller airports, which

---

² Oum, T.; Zhang, A. (2001)
enable the user a relatively short transfer time. Another market segment with high growth rates is that operated by low-cost or “no-frills” carriers.

1.2.2. Rail services

The “regionalisation” of regional and local rail services, which implies shifting the responsibility for such services to local and regional authorities, will increase competition among railway companies and the level of service. Costs for such services are expected to decline.

The future existence of the inter-regional service segment, the service segment in between regional and long-distance services, has become questionable. In several European countries such services have been being cancelled or have been being substituted by regional services, which are under the responsibility of local and regional authorities.

In the long-distance rail segment the tendency towards more demand-driven services will continue. Operators will apply receipt-maximising pricing strategies, which take into account of the relative competitiveness of the rail mode on a certain O/D relation and which also consider user sensitivities with regard to travel disutilities. The tariffs applied for long-distance rail services will become subject to a yield management system with highly differentiated tariffs being comparable with the tariff system applied in the air market.

1.2.3. Long distance coach services

In some EU15 countries and many accession countries the market for long-distance coach services has a relevant magnitude. In accession countries the market segment for international coach services is an emerging market segment, while the demand for domestic services has been decreasing. These trends are expected to determine the future development of level of service of long-distance coach services in accession countries.
1.2.4. Impacts of new information and communication technologies

The technological development of advanced communication facilities concerns all modes. Both public and individual modes will gain from telematics applications. Telematics applications enable an optimal organisation of inter-modal trips and an improvement of interfaces between different modes. They can provide the user with seamless mobility chains. Furthermore, the capacity of transport infrastructure can be enhanced.

The effects of route-guidance systems are (objectively) limited, but might be perceived differently, since they come along with higher certainty of information for the customer. Limited information is available to which extent electronic assistance applications (Personal Travel Agents) actually change behaviour. Well-adjusted transport models, which are sensitive to individuals’ improved level of information, do not exist yet.

1.2. Effects of demand and supply side evolutions: Increasing volatility and complexity of trip making

Presentations and discussions on the THINK-UP events have underlined that the passenger transport market has been becoming more and more volatile and complex. This has been caused by various evolutions on the demand and the supply side.

Especially the tourism market segment is an extremely volatile market with demand structures being very difficult and challenging to predict. The growing number of holiday and leisure trips per household and year and shorter duration of holiday trips underlines this development.

On the demand side following factors are responsible for growing volatility of trip making:
• More flexible working time allows more alternatives in planning leisure or holiday trips (e.g. extended-weekend trips).
• Destinations are often subject to fashion and life style issues. Fashion is subject to permanent and often unforeseeable changes.
• Continuously increasing household income makes higher mobility rates affordable.
• The number of well-off and mobile elderly people has been growing.
• Increasing individualisation within societies results in higher level of independence of individuals, which can come along with the generation of more spontaneous trips.

Following trends on the supply side encourage increasing volatility of trip making:

• The tourism industry has been offering more and more different kinds of specialised services for spending holidays (e.g. wellness holidays, club holidays, adventure trips, packages for active holidays, courses).
• The provision of last-minute offers comes along with spontaneous trip making of individuals.
• The destinations offered by the tourism industry have been becoming more and more exotic and are more and more far-away (e.g. skiing in Canada, club vacation on Jamaica).
• The use of new information technologies, especially of the Internet, have provided the tourism industry new possibilities for information, advertising and marketing purposes. The alternative of booking tickets and even complete holiday packages in the Internet makes a comparison of services easier and may encourage users of booking more spontaneously.

Increasing complexity of passenger transport demand is not only characterised by higher volatility, but also by trends towards the generation of complex trip chains.

Following demand side trends may support complex trip-chaining:
• Due to a higher flexibility in working time trips from and to work can be integrated more easily in a multi-purpose trip chain. Flexible working time also allows a better combination of business and leisure trips.
• The number of mobile and active elderly people has been increasing.

Following offers by passenger transport service providers encourage trip-chaining:

• Daily tickets by public transport operators, which support the generation of multi-purpose trip chains.
• Long-distance operators, mainly airlines and in the near future also rail operators, apply highly differentiated tariffs with special rates over the weekend. This results in a more frequent combination of business and leisure trips.
2. Modelling, forecasting and understanding passenger transport demand

2.1. Use of elasticities

Regarding the use of elasticities for forecasting transport demand strong assumptions about homogeneity and stability of behaviour are required. Presentations have illustrated how different behaviour patterns are in different European countries. Strong differences across European countries with regard to holiday and leisure traffic are illustrated by Figure 4.

![Figure 4: Number of trips abroad per inhabitant in European countries for tourism purpose](source: ETM-INRETS)

Even within the same country there are significant differences by regions: Results of an Italian survey show significant differences in mobility behaviour of inhabitants by geographical entity (e.g. Northern Italy versus Southern Italy) and by region types (urban region versus rural region), which is illustrated by Figure 5.

These examples and the essence of discussions have shown impressively how important it is to apply a fine differentiation of behavioural elasticities. Elasticity
approaches are valuable for a first assessment of a policy measure, but one has to be very careful when applying them to a specific project or a policy bundle. For elasticity approaches a very fine segmentation and differentiation of the market is strongly recommended.

Source: Isfort

Figure 5: Examples for differences in mobility behaviour by regional entities and municipality size
2.2. A variable with increasing importance: time of the trip

There are recent trends, which require a more detailed view on transport modelling in terms of temporal differentiation:

- Telematics: The provision of information by telematics-based applications is a task, for which “time” is a decisive factor.
- Infrastructure charging/ tariffs applied for air and long-distance rail services: As soon as peak pricing policies are applied, the factor “time of the trip” becomes a crucial element.
- Transport service providers are interested in dampening the transport demand within peak hours and in increasing the demand within non-peak hours, i.e. to shift peak demand to non-peak periods.

Widening the temporal horizon of transport modelling comes along with the requirement to identify rhythmic patterns in the travel behaviour of individuals. A descriptive analysis of average longitudinal behaviour of individuals comes to the result, that on the one hand widely routine character of travel behaviour can be confirmed, as well as the existence of fixed temporal structures, on the other hand high intra-personal variability can be identified (e.g. of departure times of first trips of the day). Another approach to capture intra-personal variability is the sequence analysis, which, however, lacks a generally accepted procedure to identify similarity of behaviour over a longer period of time. Furthermore, survival analyses can be applied to model rhythmic behaviour by putting the occurrence of a special pattern in dependence to the time elapsed since the last occurrence of the same pattern. The analysis of activity scheduling over a six-week reporting period shows a clear rhythmic of activity performance also for leisure activities, which are less subject to exterior constraints than e.g. trips to work.

Combining temporal structure analyses with spatial information seems a promising approach for modelling individuals’ travel behaviour.
2.3. Subjective variables

The discussions on the THINK-UP events about passenger market segmentation have shown that for mobility behaviour not only objective, measurable factors (disutilities) are relevant, but also subjective factors. The importance of following subjective factors has been stressed:

- Perceptions
- Constraints
- Individual level of information about services
- Values and attitudes

Perceptions (perceived disutilities) are the basis for individual decision making rather than real, objective disutilities. Several studies have identified individuals’ perceptions to be mostly in favour of individual motorised transport modes.

Constraints can either imply “hard” or “soft” constraints. “Hard” constraints can be characterised as fixed external restrictions associated with a trip or a trip chain, e.g. the requirement to minimise travel time or travel costs, or the availability of a defined point of time for departure and a fixed point of time for arrival at a destination. “Soft” constraints are associated more towards individuals’ attitudes. An example: In several studies the strong negative image of bus use in the UK has been identified as such a constraint.

The level of individuals’ information about transport services is a decisive factor for the choice of a mode. Especially rail services and services provided by public transport modes in urban areas suffer from potential users’ low level of knowledge and information about these services.

Attitudes and values have a relevant impact on mobility behaviour patterns: A survey identified attitudes and values as determinants of modal choice (see Figure 6).
Changing attitudes with regard to mobility behaviour can be an adequate measure to provoke modal shift. However, in order to achieve modal shifts, a holistic approach has to be applied, which combines awareness-arising campaigns with improvements of alternative modes.

Source: PTV

Figure 6: Impacts of individuals’ attitudes and values on the use of modes
2.4. Travelling – only a means for reaching a destination?

On the THINK-UP Workshop on Policy Factors and Mobility Prediction a paper has been presented, which explores the conceptual basis of a positive utility for travel and which illustrates results from an ongoing empirical study of attitudes towards travelling. Results of the empirical study show that the amount of travel demand is heavily influenced by the individual’s attitudes towards travelling. In a survey raised in the United States people confounded that the utility of a trip consists of following three elements:

- Activities conducted at the destination
- Activities conducted while travelling
- Activity of travelling itself

It is obvious that these three utility components of trip making are weighted differently by different people and are, furthermore, dependent on travel mode, travel purpose and individual circumstances. The paper strongly suggests to view travelling not only as a disutility, but rather as a good with positive and negative characteristics. These findings should encourage to approach modelling transport not only from the viewpoint of measuring disutilities, but also to take into account subjective factors. A focus on the utility of a trip for its own sake is useful to understand a relevant share of passenger transport demand.

2.5. Pre-commitments

Pre-commitments are considered to have major impacts on travel behaviour and should be taken into account for modelling and market segmentation. Considering pre-commitments, however, should not be restricted to car-ownership. The ownership of seasonal tickets for public modes (e.g. monthly tickets or customer
cards, like BahnCard in Germany, General-Abonnement or Halbtax-Abo in Switzerland) is worthwhile to be considered as well. The choice of location of housing can also be considered as a pre-commitment, since long-term decision for housing locations influence all relevant features of future trips (e.g. in terms of trip lengths, availability of modes).

2.6. Increasing volatility and complexity in trip generation: Implications for modelling

Various trend on the demand and supply side have been resulting in highly volatile and complex demand structures.

In particular the holiday and leisure market is extremely volatile and, as a consequence, demand is difficult to predict. It has proven that classical modelling approaches are less capable of capturing such volatile demand structures. Demand on the holiday and leisure market is driven not only by “hard”, measurable variables, like age, gender, income and household size, but very often also by fashion issues, which are not only difficult to predict, but also ephemeral and subject to steady change. For modelling highly volatile holiday and leisure demand it is recommended to take into account “soft” factors, like individuals’ attitudes, values and life style characteristics. With such variables leisure activities can be explained and predicted much better than by “hard” variables.

In order to model the increasing complexity in mobility behaviour it is desirable that a model is capable of considering multi-modal and multi-purpose trip chains – especially the latter is a big challenge.

3. Competition between modes

Two competitive fields have been subject to discussion: the long-distance market segment “high-speed rail versus air” and the short distance market segment “passenger car versus public modes in urban areas”. The most important results are dealt with in the present chapter.

3.1. High-speed rail versus air

When discussing the competitive market between high-speed rail and air it is crucial to distinguish at least between the trip purposes business and leisure/holiday. For the business market segment it is important for the user to reach the destination with a travel time no longer than three hours in order to be able to arrive and depart on the same day. Therefore for the business market segment the “3-hour target” is decisive for the service concept of high-speed rail operators. Especially for the market segment of holiday and leisure trips the passenger car is an important competitor, too. In this market segment the modal choice is strongly influenced by the number of persons, who travel together.

The introduction of high-speed rail services in Western Europe has shown that improved supply levels have generated a considerable amount of additional demand (induced traffic).

With respect to the most important determinants of the modal choice for high-speed rail and air modal captivity plays an important role. Also travelling habits of individuals and the image of the modes as well as the availability of information about the services are relevant.

As far as air transport within Europe is considered, it is crucial to differentiate between O/D travellers (destination of the flight is the final destination of the passenger) and feeder travellers (destination of the flight is not the final destination of the passenger; hub-spoke or hub-hub services). O/D travellers can
be shifted from air to high-speed rail more easily than feeder travellers. However, for high-speed rail operators it is important to reach also feeder traveller. For this purpose close co-operation between rail operators and airlines is required.

On most long-distance O/D relations between smaller cities the level of service by regional airline carriers is often significantly better than that offered by rail, which results in a low rail share.

### 3.2. Passenger car versus public modes in urban areas

The competitive market between public transport and usage of private passenger cars in urban areas is influenced by a growing complexity of travel behaviour patterns (trip chaining), which have a high affinity to the passenger car mode. In many cases the recent development of the settlement structure around agglomerations has made it more difficult for public transport operators to provide efficient and high-level services.

Public transport has had to face the problem that individuals’ perceptions of travel disutilities are in favour of individual transport, which is partly due to a lack of information on public transport services and to complicated tariff structures of public transport.

Marketing measures for public transport can be very successful and can result in a significant increase in patronage (especially in non-peak patronage) at costs, which are amortised in less than one year.

The importance of providing potential customers enough information about the attractiveness of public services should not be underestimated. In many cases the main lack is not the service itself, but the availability of information on the service. Often complex and difficult tariff systems prevent potential users from using public transport services. A suitable approach in this respect seems to be a customer-friendly multi-operator contactless debit card, which enables the user
travelling with public transport without having to find out the right tariff before the trip.

In several cases public transport has proved to be very successful in operating niche markets, like connections to airports or leisure centres.
4. Segmentation of the Passenger Transport Market

4.1. Introduction

Defining market segments is a compromise between differentiation and aggregation. For modelling transport at European level it is not feasible to model mobility behaviour for each individual person. Thus there is a requirement to define market segments, which subdivide the whole population into groups. The particular segments should be differentiable, while the elements within a segment have to be as homogenous as possible. For the objective of analysing the effects, which policy measures have on the passenger transport market, it is necessary to define segments by pooling mobility behaviour-homogenous individuals. For a cross-segmentation approach both demand and supply variables will be taken into account.

When segmenting the passenger market a “segmentation tree” can be built up, which consists of different levels (see Figure 7). The elements on the same level belong to the same segmentation criterion. The elements on a level i represent sub-classes of that element on level (i-1), which in the segmentation tree is the origin of the elements on level i.

![Figure 7: Segmentation tree](image-url)
4.2. Market segmentation and functional form of the utility function

Market segmentation should not be discussed without further specification, especially not without specification concerning the functional form of transport models’ the utility function.

Generally speaking, there are two kinds of utility functions: linear and non-linear ones. Linear ones represent a constant impact of generalised costs on utility, and result in a symmetric probability function converging to zero and one. Non-linear utility functions, whose variables have been subject to a transformation (e.g. Box-Cox transformation), are often superior to linear ones in terms of matching better to real world data. Non-linear utility functions result in asymmetric probability functions. The behaviour of elasticities differs strongly between known linear or multiplicative forms on the one side and their optimal, non-linear form (variables of the utility function transformed by a Box-Cox transformation) on the other. In some cases the elasticities can even change their sign. Non-linear forms can be used to derive the best way of segmentation endogenously from the model. This brings in a new dimension into the segmentation discussion, which is usually based on cluster analysis or exogenous definitions. Thus for the objective of generating a market segmentation based on model outcomes a combinatorial approach should be applied, which combines considerations on market segmentation with considerations on what type of utility function is applied for modelling.

4.3. Building-up a segmentation approach

There is a wide range of different possibilities of creating a segmentation tree. The motivation for the market segmentation can be

- model driven,
- policy driven, and/ or
- data driven.
A model driven market segmentation approach strongly takes into account the requirements of the models applied. A policy driven segmentation approach is supposed to allow a sound assessment of effects of transport policy. The latter method is characterised by a segmentation approach mainly orientated on data availability and data structure.

4.4. Segmentation approach applied by THINK-UP

For the segmentation approach applied by THINK-UP one possibility will be selected out of the huge set of alternatives. The resulting segmentation has to meet the target to constitute a market segmentation, which is not only consistent, but also adequate for an approach to examine the effects of different kinds of policy measures on specific market segments. The segmentation is not generated endogenously from a model, but derived by a top-down approach illustrated in the present paragraph.

4.4.1. Segmentation variables

4.4.1.1. Demand side variables

Demand side variables can be subdivided into trip characteristics and user characteristics. Following demand variables have been assumed to be relevant for the segmentation of the passenger transport market:

Trip variables
- Travel purposes: work, education, shopping, leisure, business, holiday
- Regularity of a trip: regular trips, occasional trips
- Trip length by distance classes
- Time of the trip
- Spatial character of the trip
**User variables**

- Socio-demographic factors: age, gender, households size
- Socio-economic factors: household income, employment
- Pre-commitments: car ownership, ownership of seasonal tickets
- Subjective factors: information, attitudes, values, perceptions, constraints

4.4.1.2. Supply side variables

The supply variables are represented by the service segments, i.e. the modes. According to the discussions on the THINK-UP events mentioned above following modes are to be considered:

- Air
- Rail
- Coach (long distance services)
- Individual motorised transport
- Public transport (regional or local public transport modes: coach, tramway, subway, etc.)
- Non-motorised modes (walking and cycling)

Further differentiation can be made as follows:

- Air: differentiation by scheduled services and charter services; demand for scheduled services on hub-spoke and hub-hub relations to be further differentiated by O/D and feeder demand
- Rail: segmentation by long-distance services (with further differentiation by high-speed services and conventional services) and regional/ local services
- Public transport: classification of the operation by core and niche markets
4.4.1.3. Cross-Segmentation

For a cross-segmentation approach the supply side variables (service segments) will be joined with the demand side variables (trip characteristics and user characteristics), which is illustrated by Figure 8.

![Diagram of demand and supply variables]

Figure 8: Demand and supply variables

4.4.2. Derivation of a Segmentation Tree by a Top-Down Approach

The segmentation approach to be developed has to meet the objective to be adequate in terms of allowing the analysis of effects of transport policy measures taken at different political levels. Transport policy in the EU countries is made at

- supra-national level (EU level),
- national level (national ministries),
- regional level (e.g. federal states, régions) and
- local level (e.g. cities, local authorities).

According to these levels of transport policy-making the segmentation criterion on the first level of the segmentation tree is the variable “functional trips”, which
combines the two trip characterisation variables “distance of the trip” and “spatial character of the trip”. Following functional trips are defined:

- Inter-continental trips: Long-distance trips from European countries to American, Asian, African or Australian destinations.
- Continental long-distance trips: Long-distance trips within Europe.
- Regional trips: Regional trips within rural areas or regional trips in densely populated regions (suburb-suburb).
- Agglomeration-surrounding trips: Trips between a bigger city or agglomeration and the surrounding.
- Intra-agglomeration trips: Trips within a city/ agglomeration.

An allocation of transport policy measures by administrative levels to functional trips is illustrated by Figure 9.

![Figure 9: Allocation of transport policy levels to functional trips](image)

The resulting segmentation is pictured by Figure 10.

![Figure 10: Segmentation at the first level](image)
In the next step the functional trips are crossed with the supply parameters (Table 1). Thus the segmentation criterion at the second level is the mode. The service segments “Regional/ local public transport services on core markets” and “Regional/ local public transport services on niche markets” have been merged into one service segment. The resulting segmentation branches are pictured in Figure 11.

Table 1: Functional trips crossed with modes in competition

<table>
<thead>
<tr>
<th>Functional trip/modes in competition</th>
<th>Air (scheduled flights)</th>
<th>Air (charter flights)</th>
<th>HS R</th>
<th>Conv. rail (long-dist.)</th>
<th>Coac h (long-dist.)</th>
<th>Pass . car</th>
<th>Loc ./ reg. rail</th>
<th>Loc./ reg. public transpo rt</th>
<th>Non-motori s-ed modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTER-CONTINENTAL</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continental long-distance</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional</td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Agglomeration-Surrounding</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Intra-agglomeration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>
Figure 11: Segmentation branches at the second level

The segmentation criterion on the third level is the trip purpose. Thus in the next step the supply segments are combined with the trip purposes (Table 2: Modes in competition crossed with trip purposes)

<table>
<thead>
<tr>
<th>Modes in competition/ trip purposes</th>
<th>Work</th>
<th>Education</th>
<th>Shopping</th>
<th>Leisure</th>
<th>Business</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR (SCHEDULED FLIGHTS)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Air (charter flights)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HSR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Conventional rail (long-dist.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coach (long-dist.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Passenger car</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Regional rail</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Local/ regional public transport</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-motorised modes</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
which results in the branches pictured by Figure 12.

**Table 2: Modes in competition crossed with trip purposes**

<table>
<thead>
<tr>
<th>Modes in competition/ trip purposes</th>
<th>Work</th>
<th>Education</th>
<th>Shopping</th>
<th>Leisure</th>
<th>Business</th>
<th>Holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR (SCHEDULED FLIGHTS)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Air (charter flights)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>HSR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Conventional rail (long-dist.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coach (long-dist.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Passenger car</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Regional rail</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Local/ regional public transport</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-motorised modes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Due to the strong correlation between trip purposes and the age of the people in the next step the two demand variables “trip purpose” and “age” are crossed
(Table 3). By considering age group-specific differences in activities following age groups for the segmentation of the passenger market can be defined:

- < 6 years: Small children, trips accompanied by adults, free transportation in many public modes.
- 6-16 years: Compulsory school age, no driving license.
- 16-28 years: Working age or further education.
- 28-65 years: Working population.
- > 65 years: Retired persons.

**Table 3: Trip purposes crossed with age groups**

<table>
<thead>
<tr>
<th>Trip purposes/ age groups</th>
<th>&lt;6</th>
<th>6-16</th>
<th>16-28</th>
<th>28-65</th>
<th>&gt;65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Leisure</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Business</td>
<td></td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Holiday</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>
Finally, the age groups are combined with the socio-demographic and socio-economic variables household size, household income, employment and pre-commitments. The results are listed in Table 4 and the segmentation branches are illustrated by Figure 14.

Table 4: Age groups crossed with other user variables

<table>
<thead>
<tr>
<th>Age groups/ other user characteristics</th>
<th>HH size</th>
<th>HH income</th>
<th>Employment</th>
<th>Car ownership</th>
<th>Ownership of seasonal tickets</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-16</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>16-28</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>28-65</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>&gt;65</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
4.4.3. Resulting Segmentation

The segmentation of the passenger market has been approached by a top-down approach. The segmentation criterion have been (in this order):

- Functional trip
- Mode
- Trip purpose
- Age group
- Socio-demographic and socio-economic variables

The resulting segmentation tree – for clarity reasons only the branches for inter-continental trips are included – is displayed in Figure 15.
Figure 15: Segmentation tree for inter-continental trips
4.4.4. Incorporating further variables in the segmentation approach

Following variables have not yet been considered by the development of the segmentation tree:

- Regularity of the trip,
- time of the trip and
- subjective factors.

How these variables are dealt with is illustrated in the present section.

4.4.4.1. Regularity of a trip

The regularity of a trip has a high affinity to the trip purpose. Therefore these two variables can be combined (see Table 5).

<table>
<thead>
<tr>
<th>Trip purposes and regularity of trips</th>
<th>Regular</th>
<th>Occasional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Shopping</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Leisure</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Holiday</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Business</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 5: Correlation between trip purpose and regularity of a trip

This results in nine different combinations of trip purpose and regularity of a trip as follows:

- Trip purpose work: regular
- Trip purpose education: regular
- Trip purpose shopping: regular
- Trip purpose leisure: regular
- Trip purpose leisure: occasional
• Trip purpose holiday: regular
• Trip purpose holiday: occasional
• Trip purpose business: regular
• Trip purpose business: occasional

Thus the regularity of a trip can be considered by appending the variable “trip purpose” (where necessary) by an attachment, which indicates, whether the trip has a regular or an occasional character, i.e. to widen the number of trip purposes.

4.4.4.2. Time of a trip

The time of a trip is an important variable, both from the viewpoint of users and from the viewpoint of service providers. Recent and future developments, like the growing importance of telematics applications or time-dependant charging policies – either for infrastructure usage or for ticket rates – stress the importance of this variable. Therefore there is a need to consider it by the segmentation scheme. The time variable relevant for modelling is the point of time when a trip starts. It can be attached to the trip purpose as “time tag”.

4.4.4.3. Subjective factors

The importance and relevance of subjective factors, like individual level of information about services, perceptions, constraints and the individual assessment of in how far a trip has utility for its own sake, has already been discussed in chapter 0. For the passenger market segmentation subjective factors are suggested to be considered by an “additional layer”, which represents individual-specific reactions on transport services in addition to the conventional generalised cost function.
Subjective factors
(attitudes, information, values, perceptions, constraints)

\[ P_{ij} = f(c_{ij}) \]

\[ P_{ij} = f(c_{ij}, \text{subjective factors}) \]

Figure 16: Subjective factors
5. Conclusions to be drawn for (transport) policy

Deriving policy conclusions from the THINK-UP events subject to depiction in the present paper has not been the core intention of the presentations and discussions on these THINK-UP workshops and seminars. Nevertheless, some conclusions can be drawn – some are rather specific, others more general –, which are relevant for transport policy making. These conclusions are dealt with in the present paragraph.

A concrete policy conclusion can be derived from discussions on the evolution in the air market. The booming market for low-cost airlines and the enormous growth rates in these market segments may aggravate the problem of in-equal fiscal treatment of the modes rail and air: While the level of VAT for international rail trips differs from country to country, international airline tickets are not subject to VAT. Furthermore, fuel (and/ or energy) for rail companies is subject to tax, while airlines have access to untaxed energy. Although tariff schemes for long-distance rail services in Europe will be driven more and more by a yield management system, which allows quick reactions on the price policy of competitors, the presently prevailing in-equality in fiscal treatment of these two modes will most probably result in market distortion.

A further concrete policy conclusion refers to the close correlation between land-use patterns and the opportunities of public transport operators for providing efficient and user-friendly services: In several examples the land-use and the settlement structure has prevented public transport operators from establishing an efficient public transport system. This aspect emphasises the requirement for an integrated transport policy, which combines the planning for transport infrastructure with land-use planning.

Mobility – if seen in a context of being more than just a measure for reaching a certain destination, but with utility for its own sake – cannot be explained wholly by objectively measurable (dis-)utilities, since demand for mobility is not wholly
derived from the attractiveness of a certain destination. This view on mobility suggested by a presentation within THINK-UP allows the conclusion that there is a substantial share of mobility, whose generation process is totally different from patterns presumed usually and which eludes the classical impact mechanisms of transport policy measures.

Furthermore, it has been stressed vigorously that individuals’ decisions are not only based on the “minimising objective generalised cost” or “maximising utility” principle, but also – and in some cases to a considerable extent – by “subjective factors”, like perceptions, constraints, individuals’ attitudes and values, life-style, the prevailing image of a mode and individuals’ level of information on services. Individuals’ perceptions and images of modes are predominantly disadvantageous towards the modes rail and public transport, and often individuals’ level of information on public transport services is at a remarkable low level. Moreover for many potential users complex tariff structures of public transport systems have deterrent effects on the actual usage of such services. For such reasons “hard measures” (i.e. changes in relative costs between modes) introduced by transport policy do not necessarily result in the expected reactions, which is not only due to inertia of human behaviour, but also due to transport policy measures’ lack of taking influence on individuals’ subjective sphere.

Discussions and presentations on THINK-UP events on passenger transport markets have emphasised that, in order to achieve relevant modal shifts, a holistic approach has to be applied, which combines classical transport policy measures with “soft measures”, like awareness-arising campaigns, which aim at making individuals’ thinking about mobility in general and at influencing individuals’ images of modes and perceptions. Particularly for the competitive field of passenger transport in urban areas it is crucial that public transport operators provide sufficient information on public transport services and apply a user-friendly and easy-to-understand tariff system. This implies that political efforts have to go hand in hand with resolute efforts by transport service providers. Especially marketing and public relations departments of transport operators play
an important role in contributing to a change in individuals’ images and perceptions of modes and of providing enough and reliable information on both services and tariffs.
C. POLICY VARIABLES FOR MOBILITY PREDICTION
1. Introduction

Mobility prediction is an important part of transport planning and evaluation. Three workshops and one seminar organised by ICCR in the framework of the THINK-UP project examined the relationships between policy and mobility prediction and by default the successes and failures of policies in terms of managing transport mobility for freight and passengers, and ultimately for reducing car dependency, congestion and environmental pollution.

The first workshop "Setting the Policy Context" took place in December 2000 in Vienna (THINK-UP WS5). The purpose was to provide an overview of policy developments at European, national and regional/urban level which could be thought to potentially influence mobility and which, in turn, ought to be taken into account in mobility prediction. On the basis of the outcomes of this first workshop, the second and the third workshop "Transport Policy and Mobility Prediction" were organised in May 2001 in Vienna (THINK-UP WS8 and WS10). They sought a better understanding of the way in which the transport sector and, more generally, mobility is influenced by general developments and policy decisions. The two main themes were, first, the interaction between policy, external developments and the transport system and, second, the construction of policy variables in strategic models. The seminar on "Policy Variables in Transport Models and Transport Demand Forecasts – In Search of Harmonisation" took place in November 2001 in Brussels and investigated the feasibility to agree on a minimum set of policy or policy-relevant variables to include in system transport models.

This chapter reports on the results of the four events that took place in Vienna and Brussels between December 2000 and November 2001. The second section that follows elaborates on the policy context with reference to the development of the European transport policy and its main contemporary challenges. The third section discusses the interaction between policy, external developments and transport in mobility prediction. The fourth section advances recommendations about how to
improve the integration of policy variables in mobility prediction. The annex to this chapter includes a summary of the THINK-UP workshops and seminar from which this chapter drew its contents.
2. The Policy Context

Let us reiterate in summary the most important milestones of the development of European transport policy.

Beginning in 1985 the vision of the Common Market began to be implemented in transport as well. Several directives were enacted in order to liberalise transport services across modes and across national borders among EU Member States. These efforts were to a large extent successful, especially with regard to the road sector. The beginning of the nineties saw the revival of the older view of transport as key to overcoming regional structural inequalities, thus promoting social cohesion. As a result, the Union began to gain a policy profile also with regard to infrastructure investment, the TEN-T programme representing a new vision of equal force to that of market liberalisation. The third overarching area of European transport policy – realising an environmentally sustainable transport system – has been the least successful. Despite the successful upgrading of technical standards, the contribution of transport to environmental pollution did not decrease because in parallel there has been a significant increase of transport demand and flows – especially on the less environmentally friendly modes, i.e. road and air.

The potentially contradictory nature of the above three objectives of European transport policy – liberalisation, overcoming regional structural inequalities and realising an environmentally sustainable transport system – as well as the close interface of transport with socio-economic policy considering that transport is a derived demand and entails considerable public investments explains many of the challenges faced today. These are listed below.

*The future of the railways in the EU Member States and in the East.*

Liberalisation has not been fully implemented, and where it has (for instance the UK) it has not had the desired effects. Part of the money invested in the railways (in the East but also within the EU) should be invested in the re-training of employees and management. Investment is also needed with regard to data.
tracking / recording systems. More generally, when proposing staff reductions in railways, it should perhaps be recalled that a similar measure in the UK is not unrelated to the dramatic decrease of service and quality, including, in particular, of regional services.

*The contribution of air transport to environmental pollution.*

By frequently talking of aviation as the most market-oriented and cost-productive of the modes (itself in part a myth given the significant amount of subsidies received by the air sector) it is often forgotten that air is next to road the biggest environmental polluter in transport. In this connection solutions must be found for civil aircraft but also for military aircraft which are the most polluting among aircraft. Airport pricing is another necessary measure if the reduction of environmental pollution is taken seriously.

*The question of ear-marking of funds deriving from road pricing.*

This is often proposed as one measure that would increase the public acceptability of road pricing next to making it possible to overcome some of the structural barriers related to transport congestion or car dependency as well as problems with the financing of transport infrastructure. Such proposals need however to consider how to resolve the related issue of fiscal neutrality and/or cross-subsidising.

*The question of harmonisation and/or flexibility of road pricing policies.*

In order to be successful it would seem that pricing policies must be made flexible to take into account the differences between cities and regions with regard to the extent of coverage of social costs but also the discontinuities between different systems, i.e. urban / inter-urban / sub-urban. At the same time there is a necessity of some form of harmonisation at European level, at least with regard to the method of calculation of costs and/or the share of funds to be ear-marked for cross-subsidising or new infrastructure investment.

The calculation of external or social costs.

Subsidies for rail are often presented as a 'necessary evil' for making up for the inability of the road to cover for its social costs. This however often 'hides' a
specific interpretation or measurement of social costs which is far from agreed upon. Would such an agreement be possible? The answer appears to be no. Nevertheless, some argue, it is worse to use this lack of consensus (which seems to be very fundamental) to justify inactivity, as inactivity with regard to environmental taxation generally is certainly the worse outcome.

The impact of non-transport policies.
Till recently the Common Transport Policy was driven by competition policy, hence also the emphasis on liberalisation and the withdrawal of barriers to market access. This has however not resolved the problems of environmental pollution and congestion, nor those related to the organisation and management of transport. An in-depth assessment of European transport policy would need to consider the effects of the WTO on the transport sector, but also the challenges posed by the environment, the enlargement process, technological developments like ICT and e-commerce – also in relation to changes in labour market and industrial structures – as well as the regional and urban dynamics of human settlement and activity (for instance urban sprawl). Especially in rural or loosely populated areas, it is often non-transport and non-transport policies that determine mobility. More generally, it can be stated that mobility is the result of a combination of factors, many of which are not within the direct intervention area of transport policy.
The role of technological innovation.

How important technological innovation is likely to be with regard to meeting up to the challenges of mobility is under debate. There are those who think that given that car ownership largely drives travel demand, priority should be given to the development of the 'car of the future' over other policy measures or initiatives. Others warn against thinking of technological innovation as a panacea solution for all types of problems faced. A low-risk policy should consider other policy measures next to technological solutions.

The new White Paper on the European Transport Policy published in September 2001 addresses all the above points but smooth implementation of the proposed measures is far from certain. The fact that the market liberal approach continues to dominate in the conceptualisation of transport policy – both of problems and of solutions – could turn out a problem in the search of innovative solutions for addressing market failures.
3. Mobility Prediction and the Interaction between Policy, External Developments and Transport

Mobility predictions often fail to deliver robust, realistic and policy-relevant recommendations. This is related to the failure of the strategic planning process, in general, and of modelling exercises, more specifically, to adequately account for the interactions between policy, external developments and transport.

Even when transport is considered a derived demand, how policy or external developments (or a combination of the two) influence transport is hardly ever linear or direct, nor are the effects the same across regions, for passenger or freight transport or for short, medium or long-distance. The long-term implementation framework of transport policies (and especially transport investment) complicates the picture further.

Globalisation, Europeanisation and the inter-sectoral integration of policies make additionally necessary the investigation of the effect of non-transport policies on transport. Here the picture is far from clear-cut. The first point to make is that transport policy is not the sole determinant of mobility. Mobility is the result of a combination of factors, many of which are not within the direct intervention area of transport policy. Secondly, not all non-transport policies point in the same direction. In fact, this also applies to transport policies. There can concurrently exist policies that act to reduce travel (like macro-economic policy or land-use planning) and policies that act to increase travel (like enlargement or cross-border trade agreements). Other than that, there are developments, like e-commerce, the effect of which on transport is both positive and negative depending on the scale and scope of application: e-commerce might be expected to reduce passenger transport in urban centres but need not have as great an effect on long-distance freight transport, especially considering the sustained differences of labour costs (and fiscal systems) across countries within but also outside Europe.

The spatial variation of the impacts of transport policies (or indeed more generally socio-economic developments) is a more general problem for transport mobility
prediction. To predict an average increase of transport demand for the next decade is far from resolving the problem of transport mobility management or investment. For instance, rail use might be running under capacity in several areas, yet there are bottlenecks for rail transport as much as there are for road transport. The spatial allocation of traffic (and transport impacts) is one but not the sole reason for studying networks and network effects and accordingly setting policies.

Another problem with transport mobility predictions is the context sensitivity of policies. This is particularly shown at present with regard to pricing or infrastructure charging policies. What is an acceptable price? Will people be willing to pay? Will economic measures like pricing function in a way as to also reduce mobility? These questions remain largely unanswered for two reasons: first, because infrastructure charging or pricing measures are often conflating two not necessarily congruent objectives (namely the user-pay principle and the objective of reducing travel); second, because little is known about how individuals react to such schemes. Studies carried out show that at best the reaction to such measures is largely mixed. It is thus important to study behaviour more closely and also to pay closer attention to social values (and not only private selfish interests) when examining willingness.
4. Policy Variables in Strategic Models

4.1. Problems with mainstream approach

The standard way of introducing policy variables in strategic models is with reference to a Reference Scenario and by simulating their effect separately (as in EXPEDITE or the national transport policy plan for the UK) or as consistent sets (as in the Dutch Transport Plan NTTP)\(^4\) with reference to key variables, especially transport cost, travel time or transport demand (in turn related to GDP growth or car ownership)

There are six main problematic areas with this approach:

a) First, when following this approach it is only possible (or rather wise) to focus on those policies that are known to have a direct effect on transport and/or one which can be arguably modelled through transport cost, travel time or transport demand. Non transport policies, like labour market, environmental or social policies with significant indirect effects are difficult to model.

b) Second, it is not easy with this approach to model dynamic interfaces or feedback loops. Effects are simulated separately or for ‘families’ of policies. What is difficult to model are interactions between policies or the context sensitivity of policies.

c) Third, the spatial and temporal distribution of impacts are difficult to capture because many of the assumptions about how policies influence transport via transport cost, travel time or transport demand are valid only at the aggregate level.

d) Fourth, successful models rely on their ability to substitute or estimate low quality or missing data.

\(^4\) To mention as examples just those models discussed at the Vienna workshop. We could however add that the OECD EST, ASTRA and the modelling exercises carried out for the Norwegian transport plan follow similar lines.
e) Fifth, elasticities are difficult to estimate, often they do not exist at all in a continuous, usable form. This poses severe problems with modal shift calculations in many models.

f) Sixth, as policies are conceptualised as objectives or performance (and the success or failure of specific quantitative targets) little can be said about the pathways of implementation.

The sixth problem above can probably not be resolved through modelling exercises and should be the subject of other types of studies. However it is possible to begin to resolve the remaining problems through additional models that become an integral part of strategic models and which rely on system dynamics. One example of such a model is the Scenario Explorer for passenger transport of the TNO.

In order to develop such models it is important to be able to rely on studies that in depth look at the dynamic relationships with case examples and/or survey results. Only empirical findings can help clarify hypotheses about how the system operates. This will not make assumptions obsolete but will contribute to reducing their number or making them more consistent.

4.2. Towards a minimum set of policy variables in strategic models

The minimum set of policy or policy-relevant variables is intimately dependent on the policy problem being addressed, the policy changes being considered, and the outputs needed from the models. The following diagram, although overly simplified (e.g., it includes no feedback loops), can be used to help clarify the role of system (strategic/network) models in analysing transport policies and, thereby, to help answer the above question.

Referring to the diagram, outcome variables are the measures of the performance of the system that stakeholders care about and that policymakers would like to use in comparing different policy options. The system models represent the portions of the transport system (and other relevant systems) whose performance 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), which are outside the control of policymakers, and policy changes. The external forces are highly uncertain. Typically, scenarios are the analytical tools that are used to represent and deal with these uncertainties. Each scenario is a description of one possible future state of the world. Scenarios do not include complete descriptions of the future; they include only factors that might strongly affect the outcomes of interest, and are usually described in terms of the values of scenario variables. Policy changes are described in terms of the values of policy variables. The system models should be designed to use the values of the scenario and policy variables as inputs, or to be able to be modified (i.e., the system representation changed) to reflect these values. When the system models are run, the changes that the external scenarios and the policies produce in the structure of the system will produce changes in the outcome variables.

Using the framework in the above diagram, the answer to the question “what is the minimum set of policy or policy-relevant variables to include or describe in strategic/network models?” can now be addressed through seeking answers to the following sets of questions:

1. What performance measures (outcome variables) are to be estimated?
2. What policy changes are to be examined?
3. What scenarios are to be used?
4. How are the policy changes to be tested?
5. What system models are to be used?
6. How are the models to be calibrated?
7. What assumptions should the models rely on with regard to passenger transport costs, freight transport costs, car ownership or other?

In what follows we discuss each of the above discussions, relying on the input provided by the participants to the THINK-UP workshops and seminar.

4.2.1. Outcome variables

Standard outcome or impact variables estimated in transport models are:

- demand;
- travel times;
- emissions;
- congestion;
- noise;
- economic effects;
- investment costs and
- safety.

With reference to transport demand, the question of distribution is important, spatial and temporal as well as with regard to social groups in order to tap on social exclusion considerations – if in no other way possible then at least in terms of time of travel and travel purpose.

Spatial / regional differentiation is also important with regard to other outcome variables, like emissions, congestion, noise, economic effects, or investment costs.
Modal analysis is important for adequately describing the transport system but also for correctly reflecting on stakeholder interests, governmental expenditures and policy orientations.

If outcomes are to be explicitly considered as performance measures, then it is important to additionally define thresholds of acceptable and/or desirable limits.

Finally, double counting – a notorious problem in any transport assessment exercise – must be especially headed with regard to the measurement of economic effects and congestion.

4.2.2. What policy changes?

At the generic level, when simulating policy changes or packages in transport models it is important to begin by specifying that such an exercise must be separately carried out for:

- Passenger and freight transport as well as
- Short- and long-distance transport.

Depending on the scope of the exercise and the model at hand, one to four generic categories must thus be considered.

Subsequently it is important to specify

- the modes to be covered by the analysis as well as
- the geographical scope, i.e. European level, national, regional / rural or urban level.

Beyond this contextual level, policies can be classified into five categories as policies relating to:

- Infrastructure (investment or networks)
- Service-related improvements
- Vehicles or technology
- Prices
- Regulations

A residual ‘other’ category may be added to cover policies that do not easily fit into the above scheme or which represent a combination.

When simulating or testing individual policies and subsequently policy packages in transport models, it is important to recall that these are described differently by policy-makers or analysts, on the one hand, and modellers, on the other. Policy analysts will obviously adopt a ‘descriptive’ approach in accordance with policy documentation and will thus, for instance, talk about the modalities of financing of an infrastructure or of a pricing regime. For modellers, a policy package is only operational (with regard to modelling) if it can be ‘translated’ into the technical components of a model – length, speed, costs etc.

Besides being aware of the different ‘languages’ that policy analysts and modellers are likely to use, two caveats in the process of ‘translation’ of policy packages into modelling requirements are worth noting:

- First, policies as presented in policy documentation sometimes tend to confuse goal or targets with modalities of implementation. Thus it can arise that the goal of reducing congestion by year X by a percentage Y (with reference to year Z) through modal shift is presented as a policy. Introducing this into a model as a policy package is equivalent to committing the fallacy of confounding cause and effect and leads to tautological argumentations and results.

- Second, policy packages can often not be adequately translated into modelling requirements without making any upfront assumptions about their expected effects. Some of these assumptions are much more straightforward

---

5 For instance improvement of waiting times at borders due to the entry into force of non-transport policies, i.e. enlargement.
and analysis-neutral than others. Thus, for instance, the introduction of road pricing can be expected to influence transport costs and algorithms will have to be developed to reflect adequately such changes. On the other hand, the effect of a new link on travel speed will depend not only on the length of the link and the speed of the new infrastructure, but will also possibly be conditional on changes in services related to the infrastructure which might themselves be effects that need to be measured. Absolute objective measurement in this respect is probably not possible, which is why it is important to always be explicit about what assumptions have been made – not least in order to also be able to correct these at a later stage and upon the emergence of new and better information or empirical evidence.

Further to the above, it is clear that policies tend to closely interact with other transport-specific policies but also external developments. Both of these aspects are considered in subsequent sections.

4.2.3. What scenarios?

Besides referring to generic trends and developments about the future, the term scenarios is often used variably leading to confusions.

In his background paper prepared for the THINK-UP seminar, Warren Walker recommends restricting the use of the term ‘scenario’ to refer alone to external forces driving structural change which are outside the direct control of policy-makers in the transport sector. In that he cautions against using the term scenario to also refer to (internal) policy options like this is done in some work, especially that in the French tradition (see, for instance, the SCENARIOS or CODE-TEN project final reports). The latter should instead be referred to as policy options or packages.

Most transport analyses operate with one to three (external) macro-economic scenarios – the majority driven by GDP forecasts. Thus, for instance, the recent White Paper on European Transport operates with one macro-economic scenario (based on a annual average GDP growth of 2.5 per cent) against which three
policy options or packages are explored. On the other hand, the French master plan as well as the German transport investment plan operate with three scenarios.

It is recommended to consider more than one macro-economic scenario to reflect different possible developments and, in that, test the robustness of policy options against variable external conditions. At least one of the scenarios developed should represent a trend-break rather than the trend. A trend-break scenario assumes that what has been observed systematically over the past (for instance economic growth or a positive correlation between economic growth and transport demand) is reversed.

Most macro-economic scenarios consider the following variables: population, GDP, employment, private consumption, investment, public consumption, imports/exports and fuel prices, whereby the key variable (and the one with reference to which most others are defined) is GDP.

This approach represents the mainstream conventional approach and is quite diffused. As widespread is, however, the critique. There are two main lines of criticism:

- First, it is not enough to concentrate on macro-economic scenarios. Even if the latter are the more important for the transport system, there are other contextual developments that are important as conditional variables and which should at least be verbalised in the formulation of scenarios.

- Second, there are other variables which it would be reasonable to relate to macro-economic and/or socio-political scenarios even if they represent intermediate and not key original variables. Such variables include urbanisation, household income and its distribution, employment trends and sectoral structural characteristics. They mediate the effect of factors driving structural change and in that help understand the dynamics of the interactions.

Ideally the set of macro-economic scenarios used in transport modelling should include also those officially released, for instance, from DG-Budget or the
equivalent Ministries of Finance. However such forecasts are often either not available or not released or – more often – they are short-term.

Another problem is how European-level scenarios compare with national-level scenarios. It is unavoidable that European-level scenarios will be more aggregate and in that less refined than those developed at the national level. Also, to the extent in which scenarios, when official, tend to be informed from political rather than scientific considerations, it is obvious that coordination will not be easy.

4.2.4. How to simulate policies?

When simulating policies in transport models the question arises as to how to enter these into the model, namely, separately and consecutively, in packages, independently, in a static and/or dynamic fashion.

Given that most policies must be 'translated' with reference to the same descriptive / analytical variables (i.e. transport costs, time, etc.) and considering the known interactions and interrelationships between them, it is sensible to work with policy bundles or packages rather than individual policies. This is also closer to reality given the pragmatics of policy-making and the implementation of policies. In the real world there is hardly a situation where one single policy is operating on its own. Instead there are more or less consistent policy-mixes.

The order in which policy packages are simulated depends on the objective of the exercise. Some sets of policy packages are defined in a cumulative manner – this is, for instance, the case of the policy options tested in the White Paper on European Transport Policy (2001): the first policy package considers road pricing alone, the second road pricing and improvements in the rail sector, the third road pricing, improvements in the rail sector and substantial investments along with several other accompanying measures. Clearly the objective of policy simulation in this case is to compare the effects of the different policy packages. The way to proceed is thus to test these consecutively and in an independent manner.
Most transport models currently available are static, i.e. they do not include feedback loops that would allow the incorporation of system responses to the introduction of policies. The development of dynamic models would however be desirable and at present possible given the many studies available on the impact of policies and behavioural reactions to these – whether from the sector as such at the macro-level, firms at the meso-level or individual users at the micro-level.

4.2.5. What system models to use?

Every transport model includes a series of algorithms or functions that allow the estimation of the outcomes of external or policy variables – for instance, the effect of the introduction of road pricing on congestion under conditions of economic growth, or the effect of rail infrastructure investment on modal shift under conditions of recession. These are referred to as system variables or system models depending on their level of complexity and the extent to which they form an intrinsic part of the transport model or separate elements.

The choice of system models depends on the geographical coverage of the exercise, the level of aggregation of the network, the stage being modelled (production / attraction, distribution, modal split or assignment), the types of impacts assessed (economic, environmental, congestion, etc.) and not least the overall assumptions underlying the forecasting and/or assessment exercise (for instance regarding the impact pathways).

Where different models are combined – increasingly the case in European-level assessment or forecasting exercises – it is important to ensure their consistency with regard to the underlying assumptions as well as technical aspects, like the level of zoning used.

4.2.6. Calibration

Important for the step of model calibration is the choice of data. Specifically, it is important to calibrate on the basis of real data and not data estimated through
other models. The time frame of the data used for calibration is also important. The longer this is, the more certain one can be about the robustness of the model.

4.2.7. Assumptions

The importance of being explicit about the assumptions entailed in transport models for the purpose of transparency, on the one hand, and for ensuring the consistency of the assessment exercise, on the other, was repeatedly underlined in THINK-UP discussions. This applies to general hypotheses and impact functions, but also especially to specific key input variables like passenger and freight transport costs and car ownership.

For passenger and freight transport costs it is important to collect reliable and time-series data on a detailed level regarding car operating costs and tariffs by modes. With regard to car ownership, besides sales and prices it is important to monitor developments in occupancy and trip rates.

4.2.8. The importance of documentation

The above guidelines with regard to the use of policy variables in transport modelling build on existing knowledge and experience with mobility prediction in the broader field of policy analysis. Unfortunately the praxis in this field leaves often much to be desired. The poor documentation of several models aggravates the lack of transparency and undermines the credibility of forecasts and assessments. It is for this reason important to establish standards about mobility prediction that future modelling exercises adhere to.
5. Conclusions

Mobility prediction at European level has made considerable progress in the last several years, not least through the support for RTD provided by the Fourth and Fifth Framework Programme of the European Commission.

A major challenge for contemporary mobility prediction is the better integration of (transport and non-transport) policy concerns in strategic models, both with regard to the description of external developments driving structural change and the comparative testing of policy options, packages or modules and their transport impacts.

This chapter has reported on the consultations that have taken place in the framework of the THINK-UP network on this topic. These consultations have shown that while there will always be a certain gap between policy assessment and mobility prediction via modelling because of the differences in terms of scope between the two exercises, the constraints of technical tools or the non-availability of comparative data, this gap can be reduced through strategic models with a strong conceptual and theoretical basis and an understanding of policy processes.

Such an understanding can, in turn, only be achieved through the setting up of multi-disciplinary teams in strategic transport research and the promotion of knowledge transfer across disciplines as well as national borders.
The objective was the assessment of the state-of-the art of the forecasting tools which respond to European and national policy questions in order to identify the most suitable model and/or combination of models for the forecasting exercise and sensitivity analysis.

Three deliverables have addressed this problem with an in-depth investigation of national and European models and comparison of results and sensitivity in particular as regards modal split.

- D2: ‘Modelling trends in national and European projections’
- D8: ‘Integration of Supply and Demand factors, and sensitivity of modal split’
- D11: ‘Review of European Modelling results as regards model specification’.

The two final workshops, workshop 11 and workshop 12 concentrated on discussions relative to the results of EXPEDITE with participation of representatives of member states. This chapter of the final report concentrates on main conclusions and recommendations which can be drawn from this analysis and concertation process so that use of models in Europe can be improved and better adapted to policy objectives. Quantitative figures from different hypothesis and models results are also produced to stress the importance of differences but also similarities in reference.

The two final workshops were:

- THINK-UP Workshop 11: Review of Interzonal and National Model Runs (25 January 2002, Kasteel Oud-Poelgeest, Leiden, The Netherlands) was aimed at providing a response to the EXPEDITE national model results on the basis of recommendations made in the previous seminars/workshops of WP5: (i) S1: Review of national and European models (See D2); and (ii) WS9: Integration of supply and demand factors, and sensitivity of modal split (See D8).
  It achieved its ends by covering two main themes:
  - Passenger transport review of interzonal and national model runs;
- Freight transport review of interzonal and national model runs.

- THINK-UP Workshop 12: Final EXPEDITE Forecasts & European Model results. Reactions from Member States (11 September 2002, Homerton College, Cambridge, UK) was aimed at discussing the final EXPEDITE model predictions and other available model results (e.g. from SCENES project) as regards model specification.

It achieved its ends by covering two main themes:

- National trends: meta-model results and reaction from Member States;
- International Trends: reactions of ATOM, SPOTLIGHTS & other European forecasts.
- Reactions from Member States.

WP 5 of the THINK-UP project brings together the main results achieved through 1 seminar and 3 workshops. Three deliverables synthesise the presentations, discussions and main conclusions and recommendations for reaching a consensus on projection tools and trends estimation between at European level:

The current deliverable D11 will make the link between all activities of WP5 and will present the final conclusions and recommendations. The first four subsections will concentrate on the summary of discussions and questions raised, and the fifth on tentative conclusions.
1. A typology of European models?

The cat. Summarising seminar S1, a wide range of models have been presented which can be provisionally sub-divided into the following rough groups:

- Trips generation (short distance) mobility (national models)
- Regional input/output models (such as STREAMS/SCENES)
- Regional Gravitational models (such as NEAC)
- Logit/Utility based models (such as STEMM/SMILE)

The first family is currently used to determine the trip mobility according to clusters based upon income, demographic, household and motorization characteristics. There is normally a wide consensus to use such models on short distances, although it should be checked to which extent trip propensity factors are applicable to several countries or are specific by country.

The second and third families emphasize differently the way in which transport demand is derived from economic activity factors, and attempt to make a link between the economy of the regions and the volume of transport between regions pairs. Gravitational models are very flexible and necessitate a good socio-economic regional database. Input/output models are more accurate in making the link economy/transport but suffer from a lack of update input/output information on a regional basis, and necessitate a high level of detail of the economy.

The last family attempts to determine a probability of making one or another choice of transport organisation. A multimodal approach, like SMILE, is now tested in the context of the SCENES project. The question arises whether the detailed SMILE approach developed for the Netherlands is applicable in a European context, and again the need and the constraint of detailed information to apply such an approach.
Skinning the cat: a pedigree approach? But, of course, there are many ways to skin a cat and people combine the different approaches, or see them in different ways. For instance, NEAC effectively combines a demand step of type (i) with a gravitational approach of type (iii).

For this reason, the SpotlightsTN consortium recommended that a model be “recognized” only if a proper pedigree is associated to it. This affirms the existence of multiple families of models, and of ways to combine them, and shifts the burden on the modeller to make reasonably clear how the model works.

Relative urgency of passenger and freight model comparisons. Concluding a comparison for passenger models was less urgent since EXPEDITE already had a thorough overview of these models. Open questions on long distance passenger transport could be looked at either within EXPEDITE, or by paying specific attention to the long distance oriented models like MATISSE. Also the results of SCENES should be evaluated in this context.

For the freight it was recommended to organise a Task force that went further and made a thorough start with a model comparison exercise, incorporating at least the following dimensions: Origin-Destination, Transport Modes and Products. An example of such a comparison is the comparison between the NEAC and the STREAMS freight model, which is done within the SCENES project. The results of this comparison are part of the deliverables of SCENES.

Freight Task Force. The Task Force effectively met for these purposes on December 20th at INRETS (Arcueil, France), specifically to evaluate the abilities and limits of existing freight models in Europe.

For this purpose, two sets of models were distinguished and a particular model focused on:
• The EXPEDITE family models (4 models) that could be run especially for the purpose of trend estimation of different market segments, as well as for modal sensitivity analysis to different policy measures;

• Other models for which extra model runs might require additional resources. Nevertheless, the existing results of these models can sometimes give relevant information as regards the objectives of Think-up project concerning the core/competitive segmentation approach;

• An additional model assessed, was the SCENES model. The SCENES Model has been acquired by the EXPEDITE team and there was an opportunity to influence the definition of SCENES scenarios to be run so that the results will be also useful for Think-up project.

Trends for market segments within different model layers. A relevant way to compare freight models could involve a “trend analysis” for different market segments. This analysis could take into account:

- Qualitative considerations complementary to quantitative results of the models;
- Results of different models if, for the same segment, different estimations were available, or more generally, a determination of Segments and of their Trends.

How could segments be defined? What is a segment? Spontaneously, it is a part of a market. But, as the models have different levels/layers, market segments should be considered within a layer. In this way, comparisons, for a given segment, among model results could be provided within a reasonably common understanding of what was held constant and what was not in the comparison, because the “layer” was defined.

To do this (see D2), it appeared to make sense to take advantage of the standard 4 steps of the classical transport demand format and to extend it in such a way as to define some 10 “layers/levels” within which the response of a segment to changes
in various variables could be understood. Whence Table 1, where 10 layers are defined.
This made it possible afterwards to associate models to layers, as done in Table 2.

**TABLE 2: nine existing model families and layers addressed by each**

<table>
<thead>
<tr>
<th>Models</th>
<th>Nine tasks</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPEDITE</td>
<td>1⊗6, 10</td>
<td>National +</td>
</tr>
<tr>
<td>(Runs)</td>
<td>1⊗6, 10</td>
<td>National +</td>
</tr>
<tr>
<td>- SAMGODS (SW)</td>
<td>1⊗6, 10</td>
<td>National +</td>
</tr>
<tr>
<td>- NEMO (Nor)</td>
<td>1⊗7, 10</td>
<td>National +</td>
</tr>
<tr>
<td>- WFTM (Belgium)</td>
<td>1⊗6, 10</td>
<td>National +</td>
</tr>
<tr>
<td>- ARPA (Italy)</td>
<td>1⊗6, 10</td>
<td>National +</td>
</tr>
<tr>
<td>Think-up</td>
<td>1⊗6, 9⊗10</td>
<td>Europe ++</td>
</tr>
<tr>
<td>(Results)</td>
<td>1⊗6, 8, 10</td>
<td>Europe +</td>
</tr>
<tr>
<td>- NEAC</td>
<td>1⊗6, 9⊗10</td>
<td>Europe ++</td>
</tr>
<tr>
<td>- EUFRANET</td>
<td>1⊗6, 8, 10</td>
<td>Europe +</td>
</tr>
<tr>
<td>SCENES</td>
<td>1⊗7, 9</td>
<td>Europe</td>
</tr>
<tr>
<td>(Runs?)</td>
<td>1⊗6, 9</td>
<td>National +</td>
</tr>
<tr>
<td>UK</td>
<td>1⊗3, 5⊗6, “9”</td>
<td>National</td>
</tr>
<tr>
<td>FR</td>
<td>1⊗6, “7”, “10”</td>
<td>National ++</td>
</tr>
<tr>
<td>NL</td>
<td>1⊗7, 9</td>
<td>National</td>
</tr>
<tr>
<td>- TEM</td>
<td>1⊗6, “7”, “10”</td>
<td>National ++</td>
</tr>
<tr>
<td></td>
<td>(Growth model approach)</td>
<td></td>
</tr>
</tbody>
</table>

(1) National +: National + International links
(2) Europe + : Europe + Central Europe
(3) Europe ++: Europe + Central Europe + Individual Intercontinental Flows

Considering the available models in Table 2, it appeared, that almost all the models gave information on levels 1 to 6 of the process, with national, international (international relations of a given country) and European scope. For the levels 7 to 10, obtaining information would be more difficult and qualification analysis necessary to complement the quantitative results of the models in order to “bridge” the gap between what is “desirable” and what is “possible” for the estimation of trends within the layers or “segments”.
The conclusion stressed the import of the co-operation between Expedite and Think-up, for which future objectives were outlined:

- to provide a comparison of models’ results following the analysis developed;
- to make the RUNS step.

NESTEAR (former INRETS) was then specifically assigned to compare the different model results (layers/segments 1 to 4). Later on NEA has been requested to shift resources to develop research in this area (for example comparison of NEAC and SCENES base year databases).
**TABLE 1: Ten layers for the analysis of the trends of market segments**

| Type of products (GDP-Internal Trade) | 1 | Bulk | General Cargo |
| Spatial Distribution (Differentiation) | 2 | Local (VS Regional) | National | International (European) |
| | 3 | Ton/Tonkm |
| | 4 | Country to Country Flows |
| Policy Impacts (Sensitivity) | 5 | per Mode |
| | 6 | Sensitivity to: |
| | | Price/Costs/Time | Quality |
| Logistics Changes (Industry-Transport) | 7 | Industrial Logistics: |
| | | Handling Factors | Loading Factors (Shipment Size) |
| | 8 | Transport Logistics: |
| | | Vehicles.km/Train.km (Operating Systems) |
| | 9 | Capacity problems of infrastructures (Congestion) (Environment Problems) |
| | 10 | Intermodality |

What is a market segment elasticity within a model? These tables make it clear that one must be clear on what is keep (conceptually) constant when model results
are compared. For instance, if elasticities are naturally of interest to define a “trend”, the precise layer should be clearly stated as a part of the elasticity definition; similarly, if the analysis pertains to a total flow, the “units” of the layer matters to our understanding of the stated elasticity.
2. Sensitivity of modal-split in European transport forecasting models

The workshop on modal split considered that two inputs in the modal split modelling stage were considered to be relevant (see D8) to the analysis of the sensitivity of models:

- The transport demand as derived from the distribution phase;
- The transport price/costs/time and quality of services, indicated as supply factors.

Besides the above-mentioned direct effects of supply variables on the modal split, the workshop also focused on linkages with other stages in transport model. In this respect it was important to focus on the relationship between the modal split stage and the assignment stage and from thereon the feedback to the generation stage. Part of the input of modal split model is there the road transport costs, which are on their turn determined by the volume of traffic on the infrastructure network. And also, as previously stated, increased transport times can have a negative impact on regional productivity (and conversely, as is stressed in some recent transport models).

One permanent item during the workshop was the requirements of view of policy makers, i.e. what type of information is required from the point of view of policymaking? For example, the question “On which decision variables are the effects of pricing to be evaluated?” Or “How to initiate a sustainable development of transport through policy measures?”

From the modeling point of view, the way in which the supply factors are included in the models is of importance. Subsequently the questions arise here: how are supply factors included and in which model types are they applied (for example a cross elasticity approach or a Logit modeling approach)?

The workshop on this theme was organised along three topics:

- Setting the methodological context (taxonomy) of models;
Looking for modelling answers to major European strategic transport issues;
- Exchanging experience in modelling results of major infrastructure projects.

The taxonomy of models. The first theme benefited from the work undertaken by another thematic network, SpotlightsTN, whose representative raised the question of why and how modelling is useful: e.g. if shippers choose a service (not a mode) and persons choose a package (not a mode) in getting from origin to destination, the model sets the stage for a particular understanding of how the sensitivity to policy variables arises.

The methodological overview resulted in a classification of types of modal split models:
1. Mode choice through route choice in multi-modal networks
2. Mode choice using econometric or direct demand models
3. Mode choice using aggregate Logit, or similar form, models
4. Disaggregate mode choice models
5. Marginal models
6. Simulation (Monte Carlo) models

The classification scheme is based upon a number of characteristics of mode choice models:

a) level of disaggregation,
b) differences of theoretical basis,
c) whether the choices among discrete packages is the assumed modelling vision,
d) level of detail for the components of the disutility of service packages,
e) the way in which composite service packages are built up. Mr Willumsen thinks that simulation will become more important in research in the coming years.

In the survey of more than 220 European transport models in SpotlightsTN, more than 150 have included a modal split function, and in more than 100 cases the specification of the modal split is known. The most popular form is the choice
model followed by the econometric models. Also, as a rule, passenger models are more focused on short and medium distances (regional and national level) and freight on national and international scales.

The lesson to keep in mind is that no model can answer all the questions. This implicates that one has to work more in relation with an architecture of models with their own specificity, a sort of box of tools, with a dynamic interaction between the models, often more complementary than in competition. this does not deny that models belong to different types: strategic, Meta models, and simulation models differ. Also it is not ensured that the scenario Meta models can validly to be used for network simulation (see presentation at THINK UP workshop at Vienna of the scenario model).

How are the major strategic issues addressed in Europe? As a preliminary, it was stated that a closely related question “Do we need an European model?” was too restrictive because both a kit of well documented and proven models and an agreed base of information were needed by the Member States for their national policy. Moreover, if it were of interest to construct a European model, a platform for exchanging data and scenarios (to avoid duplication) should be installed and information made available to the Member States.

Over the form of the model itself opinions vary: the dilemma is the complexity of the model system against the need of “simplicity” or better said, transparency to carry out an evaluation that can also be communicated and discussed with other ministries. We noted above that the answer of SpotlightsTN is to require that any model should be documented in a pedigree form to be considered.

The approach taken by EXPEDITE on the question of a possible model is to develop a Meta-model that can be applied on existing European transport databases, notably SCENES. The Meta-model will be developed on the basis of national freight and passenger models available in Europe. For freight, 4 models are used (from Italy, Belgium, Norway and Sweden); for passengers, 5 models are
used for constructing the meta-model (from Italy, Denmark, Norway and Sweden and the Netherlands).

Summarising the discussions, one can at this stage say that the diversity of models in Europe is not a problem as long there is a good segmentation in the models in terms of the policy effects they encompass. For example there are 3 to 4 European models, one could take them as they are (and eventually use them combined and thereby observing the different reactions of these models) in a kind of architecture. Certainly one does not need 200 models. There are many projects which compare results of models, but very little which go in depth in the output of the models. There are a few things to focus on: high speed, tourism, TINA (Eastern Europe) world, transport chain organisation (freight), particularly intercontinental freight flows and the scenarios of economic development in non-European countries. The question whether the Meta model approach of the EXPEDITE project is relevant to assess the policy questions needs more consideration, at least with respect to the forthcoming results.

Modelling experience from major infrastructure projects. With respect to the third topic, the reactions are mitigated. Models are a useful instrument of analysis of infrastructure beforehand, certainly for assessing the relative effect of various policies. Absolute figures might disappoint. The experience of the fixed link Denmark-Sweden is interesting: some predictions turned out to be wrong especially on railway traffic. Also the elasticities in the model are quite high with reaction to price changes, and it is not known if this elasticity can be applied in order to reduce the price to eventually ‘0’. Concluding the perfect tool has not been found yet but the experience is full teaching.

Relevance to EXPEDITE. For EXPEDITE, the relevant aspects of the workshop for its work were said to be:

- EXPEDITE is looking at core segments in competition, but we have to add also a segment where modes are more complementary (for example rail and air, low costs airlines segments);
• The segmentation as used in the Cross Channel market proved insights in detailed processes such as accompanied and unaccompanied transport;
• The need for a *European reference model input* is also relevant for EXPEDITE. Competition should be between models, notably their sensitivity, and not between model inputs.

**Trends by segment for given competing model architectures.** The impression from the THINK UP participants is nuanced: the competition between models can be argued. A model is a tool and the question is assessment. Bad models will not have a long lifetime, and models will never give a global understanding. The question is what model can bring up the right understanding. One has to find the right architecture: the kit of models to be applied for a given problem.

In their conclusions the participants insisted on the importance of the dialogue between the maker and user of the model architectures. This is not a one-time relationship. Decision takes place little by little. The political decision process is vague; sometimes one doesn’t know when exactly a decision for a project is taken. It is more the debate that is important, thus the role of the modeller is not a one-time experience but a range of activities during the decision process.

The outcome of the model, for example a negative rate of return, does not matter so much. A politician when necessary can go ‘against’ the negative rate of return. The model is capable of monitoring what has happened in the past and this gives on its turn a reference for the future. By getting trends by segment, reaction might be easier. and become the effective means of model comparison, as it puts them on a comparable basis.

**In toto: common data set and common scenarios; different model sensitivities.** Again, the workshop insisted on the need of a common set of data in Europe that can be used commonly in studies, with a set of workable scenarios and their assumptions specified for a European context. Then different models with the same set could be run and the differences of the models be analysed;
confrontation of different results can improve the understanding of alternative development of the transport system. ETIS could be the starting point for harmonised descriptions in Europe. The Commission agreed fully with this point.

In her final words, the Commission was aware that, when starting the workshop, it was not expected that we would arrive at a common basis like ETIS. Each of the workshops of Think-Up moved in the needed direction, as expected. For instance, segmentations within the modal split were discussed but not, directly, total impacts of services: over time, which is the best measure of comparison? Food for thought, over the long term...
3. Criteria for comparing “European” and national forecasts

The above, centred on common data, scenarios and a proper understanding of sensitivities (“trends” generated by a model) by market segment raises the issue of standards in effecting the comparisons.

Consider in particular what was learned from the construction of the Meta model in EXPEDITE from a selected and limited list of national models and their results. The process is questionable in the mind of some Member States who doubt about the application of this model to their country. What can be concluded so far with respect to this particular process?

- Experts have a similar framework of understanding, in other words, there is no extreme apparent difference that would be an obstacle to a consensus.

Having said that there are several points of attention. One is the difference in freight flows at the base year, in particular the differences in the relation EU-non EU. The importance of these flows for the EU policy is clear – they constitute 40% of the EU international traffic of goods - and also the need to use refined scenarios for each of the main non-EU partner (America, Japan etc). Also flows with Eastern Europe (and within Eastern Europe) are strategically essential in a long term study. The difference in tonnes for 1995 for EU-non EU between SCENES and NEAC is relatively big. This should be further examined and those issues are a point of attention for the Task Force of experts constituted by the THINK UP project.

- Differences that appear between the forecasts are a crucial point.
  We have to keep in mind for example the discussions between specialists over 0.5% more or less growth of the economy and the positive/negative effects they foresee (although it is often a question of perception).
"Slight" differences in GDP, growth by branch of the economy, car ownership, cost, times, high speed lines, tourism etc. might have a significant effect in the future on transport performance, congestion and emissions, even in a case transport output look like "similar" at a certain level of aggregation.

- Similarity between transport aggregated data can hide huge differences within the segments of transport, and make a policy successful or not.

- As the moment SCENES model is chosen as a standard forecasting instrument by the EXPEDITE project, the question is not to make it converging but just to use the differences with other sources to come to a common understanding of trends.

The questions and interrogations of some countries in this workshop about the results of SCENES so far and the method of the Meta model are a serious point to pay attention to. One can use these interrogations as an encouragement for building up the box of tools the June 2001 THINK UP workshop recommended last year, and not to put the models in competition. The danger is to see other European approaches diverging from national approaches, and a lack of support of Member States at the end.

**Desires of Member States.** The interest manifested by the national experts of the countries for the workshop presentations, their reactions to the forecasts, their conclusions, all of them are a signal that Member States are demanding a possibility to present and compare their methods, results and questions. Modelling experience of Member States representatives and consultants reveals to be a crucial input in the discussions and should be used on a cooperative and continuous way.
More generally the difficulty to compare and assess differences (or lack of
differences) between forecasting results, emphasises the need for a common
definition of standards in presenting results and a confrontation of scenarios, data
and methods to make them if not compatible, at least consistent. Due to the
complexity of the task, and the different ways of effecting it, this is by no means
un unambiguous affair: it will require further work to avoid unnecessary
misunderstandings with Member States.

The THINK UP team recommends, in a longer term approach, the formation of
a discussion platform, which might be a kind of continuation of the exchanges
of such a THINK UP workshop on differences between European and national
results.

This “common working model comparison platform” would avoid many future
misunderstandings by focusing on such data, scenarios and market segment
indicators.
4. Comparison of results

This comparison must take into account the differences in the choice of socio-economic hypothesis:

Transport determinants

Gross domestic products and car ownership are essential elements in the list of determinants of transport.

GDP – annual growth

In the SCENES model used by the EXPEDITE team the GDP annual growth is acceptable and comparable with the Member States and similar European projects:

- +2 - 3% EU15, + 4 – 5% CEEC in SCENES,
- +2.4% EU 15 in 2020 Forecast project,
- +2.38 EU15 in ASTRA project,
- +2.4 – 2.8 for the EU15 in the Netherlands model,
- +1.9 – 2.9 France national model,
- +2% Belgium (Flemish model),
- +2.1% Germany (derived from total growth 1997 – 2015).

Car ownership – total growth

Car ownership growth considered by the EXPEDITE project in the SCENES model is a point of concern especially for those countries where the level is more or less close to saturation: UK, D, DK, and also for the other Member States where some lower growth is foreseen.
The detailed table of determinants by country/model is presented below.

<table>
<thead>
<tr>
<th>Source</th>
<th>Transport determinants</th>
<th>Population</th>
<th>Employment</th>
<th>Car ownership</th>
<th>GDP EU15</th>
<th>GDP national</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Belgium</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>+1.7% (1997–2015)</td>
<td>+1.5% (1997–2015)</td>
<td>-</td>
<td>+18% (all population)</td>
<td>-</td>
<td>+1.9 to +2.9% per year (1995? – 2020)</td>
</tr>
<tr>
<td>Germany</td>
<td>+0.2 to 0.5% per year (1996–2020)</td>
<td>+0.3 to +1.15% per year (1996–2020)</td>
<td>+37 to +46% per year (1996–2020)</td>
<td>+1.4 to +2.8% per year (1996–2020)</td>
<td>+1.5 to +3.3% per year (1996–2020)</td>
<td></td>
</tr>
<tr>
<td>The Netherlands</td>
<td>+0.315% per year (1995?–2020)</td>
<td>+0.55% per year (1995?–2020)</td>
<td>+32% (1996–2020)</td>
<td>-</td>
<td>-</td>
<td>+2.85% per year (1996–2020)</td>
</tr>
<tr>
<td>Sweden</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>UK</td>
<td>+0.315% per year (1995?–2020)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>European models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASTRA</td>
<td>-</td>
<td>+0.15% per year (2000–2020)</td>
<td>+25.95% (2000–2020)</td>
<td>+2.38% per year</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2020 Forecasting</td>
<td>+0.1% per year</td>
<td>+0.2% per year</td>
<td>+2% per NUTS2 per region</td>
<td>+2.4% per year</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reference scenario</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCENES</td>
<td>+0.16% per year (+4% for EU15)</td>
<td>-</td>
<td>-</td>
<td>+50% (1995–2020, EU15)</td>
<td>+2 to +3% per year (1995–2020)</td>
<td>-</td>
</tr>
</tbody>
</table>
As emphasized by the Member States representatives the car ownership variable is a very important transport determinant and in consequence has a strong impact on the generation of trips. The average growth of car ownership considered by EXPEDITE is 50% for the period 1995 – 2020, while the 2020 Forecast project considers only half of it. For the CEEC area the difference is even more significant with a factor 2 for the SCENES scenario. In the Netherlands national scenario foresees a car ownership growth somewhere between 37% up to 46% depending upon the scenario, Belgium between 40% and 50%. On the other side, UK, Germany and Denmark national experts expect a much lower growth in car ownership as they have achieved already high levels.

Here it is recommended to EXPEDITE to have a closer look to the car ownership growth models in such a way to be harmonised with the Member States.

**Quantitative estimates (reference situation)**

Quantitative estimates of both base year and forecasts, together with the rate of growth give also an important indication on both the influence of transport determinants considered by each model and on the base year flows which are used as the base for forecasting. In this workshop mainly results of reference scenarios have been presented, with relatively similar trends development of prices of transport. However in case of freight transport, the European NEAC model system foresees a cheaper transport per inland waterway, compared to rail. The differences (or lack of differences) observed between the results of national runs and the SCENES model runs, cannot be explained only through differences in determinants; the complete model process (including of course the values of elasticities) is an issue to be paid attention to. The results and discussions have revealed, behind a façade of consistent economic assumptions, substantial differences for example in trip length (passengers) and some relations (EU- Non-EU freight). Surely this comparisons process necessitates more in-depth investigations.
**Passenger transport**

Important references from Member States and 2020 Forecast project are as follows:

- The increase of the number of trips is similar or grows faster (domestic trips) in national models than in SCENES, and this despite a lower growth of car ownership.
- An increase in average trip length is foreseen by almost all Member States (evidence from UK, Belgium), EXPEDITE (SCENES) and by other European models.
- The growth of total passenger x kms is in general in the national model results lower than in SCENES
- Growth of car trips shows some differences from country to country and also when the country results are compared with the EXPEDITE (SCENES), but here the base for calculations are different, because each country has an own pattern of growth of trips and the estimates of EXPEDITE (SCENES) consider all inter-zonal flows in EU. But, a comparison is useful even if is done in general terms.
- More reliable comparisons are those between ASTRA and SCENES: +7% trips up to 2020 in SCENES and +15% in ASTRA.

**Freight transport**

Important point of attention from the comparison of Member States forecasts, SCENES forecasts (EXPEDITE) and 2020 Forecast project are as follows:

- Growth of flows of goods shows some differences from country to country and also when the national country results are compared with the SCENES runs, but here the base for calculations are different, because the estimates of SCENES consider all inter-zonal flows in EU. So far one can say that the growth of flows is similar or a bit higher than in SCENES. However the modal choice results are quite heterogeneous between countries and where compared to SCENES, it is difficult to find some common line. The national
UK rail forecasts for instance, foresee a much higher growth of rail than road; this is not expected in other countries. On the other side rail/road patterns are different in France, Belgium, Germany, UK from what is found in SCENES.

- Where the geographical coverage of models is consistent, like SCENES and NEAC, there are still differences although the patterns for Western Europe. One main difference in the modal choice is the stable role attributed to the inland waterway transport in NEAC results, whilst SCENES foresees a decline of inland waterway and an increase of the rail share. This share is already much lower in the basis situation in the NEAC model compared to the SCENES model. This is probably due to the higher volume of maritime flows in NEAC that are issued from the transport chain information (short sea shipping and trade with non-EU countries). There are also high differences between SCENES and 2020 Forecast (NEAC) in the relation EU – non-EU. These should be further investigated because these flows are very important for EU policy (they represent 40% of the total international traffic of goods).

A more refined view of differences from the comparison of freight results is tabled below.
### National/European model

<table>
<thead>
<tr>
<th>National models</th>
<th>Volume growth (% tonnes)</th>
<th>Performance growth (% tonne-km)</th>
<th>Road share – Evolution</th>
<th>Rail share - evolution</th>
<th>IWW share – evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Austria</strong></td>
<td>Domestic</td>
<td>+29% (road &amp; rail)</td>
<td>+65% (road &amp; rail, domestic &amp; international)</td>
<td>60% to 63% (1999 – 2015)</td>
<td>40% to 37% (1999 – 2015)</td>
</tr>
<tr>
<td></td>
<td>International</td>
<td>+91% (road &amp; rail)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>Macro-economic sc. Europe</td>
<td>-</td>
<td>+1.5% to +2.95 per year (road, 2002 – 2020)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Scenario for transport policy: B</td>
<td>-</td>
<td>+0.9% to +3.5% per year (road, 2002 – 2020)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td>Only models to evaluate fix linked projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>Total growth</td>
<td>+1.9% without short-distance road +1.2% with short-distance road (per year, 1997 – 2015)</td>
<td>+2.8% without short-distance road +2.6% with short-distance road (per year, 1997 – 2015)</td>
<td>64% to 71, 70, 66% (per scenario)</td>
<td>20% to 14, 15, 19% (per scenario)</td>
</tr>
<tr>
<td>By corridor</td>
<td>Domestic</td>
<td>-</td>
<td>+34% (1997 – 2015)</td>
<td>64% to 71, 70, 66% (per scenario)</td>
<td>20% to 14, 15, 19% (per scenario)</td>
</tr>
<tr>
<td></td>
<td>Exports</td>
<td>-</td>
<td>+100% (1997 – 2015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imports</td>
<td>-</td>
<td>+88% (1997 – 2015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The Netherlands</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>National/European model</td>
<td>Volume growth (% tonnes)</td>
<td>Performance growth (% tonne-km)</td>
<td>Road share – Evolution</td>
<td>Rail share - evolution</td>
<td>IWW share – evolution</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------</td>
<td>---------------------------------</td>
<td>------------------------</td>
<td>-----------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td><strong>National models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Sweden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>-</td>
<td>+38% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rail</td>
<td>-</td>
<td>+10% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maritime (Air)</td>
<td>-</td>
<td>+20% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>+38% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Outside Sweden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>-</td>
<td>+38% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rail</td>
<td>-</td>
<td>+32% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maritime (Air)</td>
<td>-</td>
<td>+53% (1997 – 2010) (+82%, 1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>+52% (1997 – 2010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>+14% (2000 – 2020)</td>
<td>+56%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rail</td>
<td>-19% (2000 – 2020)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Totals</td>
<td>+12% (2000 – 2020)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>National/European model</td>
<td>Volume growth (% tonnes)</td>
<td>Performance growth (% tonne-km)</td>
<td>Road share – Evolution</td>
<td>Rail share - evolution</td>
<td>IWW share – evolution</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------</td>
<td>---------------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td><strong>European models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCENES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic EU15</td>
<td>+23% (1995 – 2020)</td>
<td>Given per country on chart</td>
<td>92.4% to 91.8% (1995 – 2020 CC*)</td>
<td>4.3% to 4.9% (1995 – 2020 CC)</td>
<td>1.8% to 2.1% (1995 – 2020 CC)</td>
</tr>
<tr>
<td>EU15 – CEEC</td>
<td>+98% (1995 – 2020)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EU15 – Rest Europe</td>
<td>+83% (1995 – 2020)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EU15 – rest world</td>
<td>+84% (1995 – 2020)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>2020 Forecast – NEAC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic EU15</td>
<td>+51% (1995 – 2020)</td>
<td>-</td>
<td>90% to 88.7% (1995 – 2020 Reference)</td>
<td>6.8% to 7.6% (1995 – 2020 Reference)</td>
<td>1.4% to 1.7% (1995 – 2020 Reference)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+201% rail, all O/D route</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Conclusions from the EXPEDITE and meta model forecast analysis

The main conclusions to be drawn from the Cambridge workshop specifically addressing the final results of the EXPEDITE project are effectively two-pronged:

- Common understanding EXPEDITE – National Models on basic assumptions and final results in terms of forecasted demand flows and elasticities;
- Common understanding EXPEDITE – Other European Models on basic assumptions and final results in terms of forecasted demand flows and elasticities.

But there are also pervasive differences in the interpretation of the results between passengers and freight demand flows that cut across these two branches. Due to the strong pressure of traffic flows of goods on transport infrastructure, and here we can mention the bottlenecks occurring on both road and rail networks across Europe, the European models developed up to now pay more attention to freight. The problems generated by passenger flows are more related to local traffic, occur at specific periods of day and have also a strong seasonal pattern.

We list the principal factual points reserving for the next subsection our summary view.

5.1. Conclusions derived from EXPEDITE – National Models confrontation

Passenger demand

- EXPEDITE is strongly linked to National Models as the Meta-model is built based on national models of the Netherlands, Norway, Italy, Denmark and Sweden.
- Passenger demand modelling is very sophisticated (more sophisticated than freight) and works at a very high level of disaggregation: 5 transport modes, 7 distance classes, 5 travel purposes, 5 population segments, 7 types of areas.

- There is a consensus reached in *assumptions* to be considered for trip generation variables. For example the *motorization growth rate* changed from 50% considered initially in SCENES to 25% as average for EU 15. This was a result of discussions in WS 11, when especially Germany has outlined this aspect.

- A problem remains the results in terms of elasticities, because inhabitants of different countries could show different behaviour, even if they fall in the same prototypical sample. This aspect was emphasised especially by Greece. That could be the case, but even if the Meta-model does not reproduce exactly the pattern for a region or country in Europe, it enables the policy makers to make a quick scan of the whole Europe with respect to strategic policy decisions.

- There is also a question of interpretation for elasticities, as what was presented reflects the behaviour of all segments of the market. For better comparisons we should compare the EXPEDITE – National Models elasticities by segment.

*Freight demand*

- As for passengers, the results should be presented by segment of the market, to have a better image of policy impact.

- Elasticities could be too high for short distance classes.

- The lorry time elasticity is much bigger when distance is increasing.

- Increasing cost/time for rail has a small impact on road. The same is observed for combined transport.

- As for passengers, the model results could not be valid for all countries with the same confidence. For example in case of Italy and Germany, there are differences between national trends and European ones. In conclusion, we should be careful in using the results in quantitative terms.

- EXPEDITE results should be considered at a very high general level, as it was mentioned in case of passenger demand.
- It looks like transport performance expressed in veh-km is more important than the tonnes-km measure as, finally, vehicles-axle loadings produce the impact on infrastructure.

5.2. Conclusions derived from EXPEDITE – Other European Models confrontation

Passenger demand
- There are not so many other European projects dedicated to passenger transport, so that it is difficult to make comparisons of the basic and forecasted flows. Anyway, assumptions for building-up the scenarios where considered in terms of motorization from the ASTRA project.
- The GDP growth is similar with other European models (ASTRA).

Freight demand
- As a result of comparisons SCENES – NEAC (2020 Forecast project), the following improvements have taken place:
  - CEEC – EU15 flows for both base year 1995 and 2020 have been taken from NEAC;
  - Swiss and Norway international flows have been taken over from NEAC.

There are still differences in elasticities between EXPEDITE (SCENES) and NEAC, especially for rail and inland navigation. Rail is more flexible in EXPEDITE than in NEAC, while inland waterway is more flexible in NEAC than in SCENES. This is a matter of model specifics, but a common platform could be built here in the future.
6. A common transport reference platform of planning model indicators

THINK-UP and EXPEDITE have co-operated well to explore the construction of a common platform of European \textit{transport demand} models. In particular, the following hold:

A \textit{common understanding} of the \textit{modelling elements or framework} at European level, achieved by associating the latest European strategic models with the National models. The consensus reached here lays on the \textit{methods} for approaching different phenomena of transport world: \textit{transport generation, distribution, modal split} and \textit{assignment} of both passenger and freight flows. The complementarity of \textit{European} strategic models with \textit{National} oriented ones is well understood and assessed: European models are very strong with respect to international flows, while the National ones gives a much more reliable representation of local mobility. This was in fact expected to happen, if we keep in mind the objectives and circumstances in which the models have been developed.

A \textit{consensus} on the \textit{assumptions of the forecasting models} with respect to both socio-economic developments as well as the infrastructure policies to be implemented on the European and national infrastructure networks.

A common \textit{understanding of the forecasted flows} estimated by different European models, even if some differences exist between European and National forecasts. This is as it should, keeping in mind the differences between European and national models as well as the differences between the levels of detail with respect to territorial zonal representation. A European model consists of, say about 300 zones covering the whole Europe, while the national model can easily include around 1,000 zones. The consensus reached here addresses especially the freight flows – see comparison SCENES – NEAC and the way both models (databases) have been integrated in terms of demand flows.
**Limited coherence of the platform.** This amounts to a coherence at the level of *generation* for both passenger and freight by transport mode and segment of the market.

We have to keep in mind that this is only the beginning of building-up a Common Modelling Platform in Europe. There will be many questions to be raised when we will approach the further steps, as integration of *distribution* phase, which means that flows between Origin and Destination should reach a consensus. *Modal split* at this level remains also a challenge for future attempts, as well as the *assignment* phase where the *traffic flows* will have to be estimated. These flows will give finally the image of interaction between *demand* and *supply (infrastructure & services)* and will be the basic element for decision makers, together, nevertheless, with the not less important *impacts* generated by these flows at the level of *society* and *environment*.

**Extending the coherence.** In consequence, there is much work to be done to define the data structures, scenario types and reference segments that allow for a coherent comparison of models. We mentioned above that such a conceptualised common reference platform should save much time and misunderstandings with member States in the future, as the discussions will not get simpler.

**A common reference platform, not a common model.** Note that this common reference platform (reference data, scenarios, identified market segments and modelling layers for which sensitivities (elasticities) are the key summaries of model properties) should not be confused with a common model platform.

**Beating our intuition, but requiring it.** Indeed, models are complex producers of results from agreed inputs, and we think that they can do better than chance or our intuition in working out the implications of policies. However, their reasonableness can only be assessed through such a reference platform: it is our intuition that tells us whether the summary input data, scenario structures and built-in sensitivities make sense. In effect, detailed knowledge of the plumbing is
not necessary if the design of the house makes sense and we know we can turn the heating buttons and obtain reasonable results from the complex system at hand.

Without this reference platform, the possibility of which THINK-UP has demonstrated, the matter will never be “at hand”. It will escape our grip and reach.

**How to get there from here?** Having this said, one can imagine different alternatives for a future integration of *European* models “references” as a first step, followed by building-up the consensus with the National exercises. This is a basic need for reaching-up consensus of policies between European Commission and the Member States and for Member States to address specific bilateral issues.

The THINK-UP Consortium thinks that a common reference platform could focus on three main levels:

- **Level 0:** European level – strategic Europe
- **Level 1:** National level – strategic national
- **Level 2:** Local level (communities, transport operators, etc.) – operational level

This is a multidimensional and complex organisation on both institutional and functional aspects. A simple representation of it is shown hereunder:
It is hard to see how the diversity of models and the multiple needs of member States could be addressed without that common reference platform dealing with model data types, scenario structures and a layered list of topical market segment sensitivities.

Again, this is not a meta model: it is a reference set of summary model indicators that define a common platform agreed to by institutions. Such sets of indicators could then form the basis of “planning models” tables in a EU-wide transport handbook.

**Did we start with a typology of European models?** A typology of European models is therefore not needed here: individual models can be documented as agreed by the SpotlightsTN project. The common platform is independent from individual models, as its first fruits have shown here. But all models have to speak words, or even sentences, from the common reference language.

**And now, how further? Aim and proposed work**

The consortium proposes to continue and extend the work that has been developed by the THINK UP network. The aim of this new network to be defined is then not only to capitalise results and experiences, to update transport projections but also to made a step further in a common understanding of these projections in a “sharing” of the analysis European and national decision makers. Such approach has already been developed in the energy sector and can be very useful for transport in dialogue process. “Sharing” common transport projections is still an important problem where – as emphasised several times - major divergences exist in expected traffic growth at national and European level, for passengers and freight, for modal split, depending upon hypothesis of references, explicit or implicit and upon the data or the type of tool used for simulation.
In the promotion of a common reference framework for transport and traffic projections the network will remain open, open to new members and other networks of excellence more specialised in mobility determinants, modelling decision process and will supply a platform for discussion and comparison of models results, as done in THINK UP Thematic network, for European and national organisations.

In THINKUP an important work on segmentation is developed stressing differences in trends according to the segments, as well as differences of sensitivities of the segments to transport policy measures. Results of THINK UP can be used for a better understanding of transport trends as regards socio-economic and transport environment, but also to assess the impact of transport policies to change modal shift.

Furthermore THINK UP thematic network as also proven to be a good platform to discuss model results, European models and national models included. THINK UP develops in close relation with EXPEDITE, which will give transport projections based on SCENES model as well as a new “meta-model” for test of policy bundles.

In the network of excellence this background has to be updated, enriched, disseminated, and closer relations with national projections exercises will be developed in order to reach a “shared” analysis on common references for transport projections.

1. Rationale for proposing a new research action

Several arguments are behind this proposal to continue and extend the work of this existing network:

- Capitalisation, updating and dissemination of existing work.
Through a fairly long period of time this network has proven to be robust and able to open, and these are important considerations for capitalisation of research. At the present time there is a risk that former results or synergies might be lost or weakened if a support to continue is not given. In the past too many transport projects have started again from the beginning with team having only a short experience of working together. To obtain good synergies within multidisciplinary teams of different countries, there is a prerequisite of a good continuity in the work.

- Transport and traffic projections still show important differences

These differences cannot only be explained with differences in hypothesis. At a time when major decisions must be taken for transport investment, for transport policy measures to limit negative impact on environment it is important to use a common framework of reference and to have a good understanding of this framework. An important domain of application will be international transport, which is increasing much faster than national transport.

- To bring a reference projection framework for dialogue between European and national decision makers

To today few countries have a good approach of international transport across their territory, and very often their projections on mutual exchanges are not compatible; this is an important problem for coordinated actions relative to harmonisation of policies and financing of projects.

- Finally to improve knowledge about transport projections

Transport modelling has always been a difficult task with many variables to be taken into account. In the network different approaches are taken on the basis of market segmentation with the combination of models results. Since the network is
not privileging a tool it remains a neutral platform for discussion as well as for confrontation with national and European results.

2. Expected results

The expected results are:

- Definition and updating of a common “reference scenario” for Europe, EU members and CEEC countries including socio-economic variables and transport policy variables (external variables, although the qualification of “external” depends also upon the model used)
- Traffic projections with distinction between international, national and regional traffics, for passengers and freight; the basis for projections will be an O-D basis, regions to regions with modal split corresponding to the reference scenario
- Build a bridge between national systems and with European information systems to ensure an exchange of consistent information and data in terms of transport variables, policy options and scenarios per segment of the market, for both passengers and freight
- Confrontation of European projections with national projections mainly for international flows
- Transport sensitivity to polity measures in particular as regards modal split; sea transport will be included, and for rail, different operating systems will be made explicit in order to better understand the potential of alternative modes
- Focus on international flows including intercontinental flows, internal flows of EU, and relations to CEEC countries and Mediterranean countries on major routes; there will be assignment on the European TEN networks.
- Updating and dissemination through website of the results
- Platform for discussion of results, feedbacks to research and dialogue with other thematic networks.
The users of the research will be:

- EU commission and European decision makers and also major investment companies
- National administrations as well as national operators for their long term strategy
- Regional administrations and operators and organise regional concentration and distribution of flows
- Research community invited to a platform for discussion and confrontation to results.

3. Activities to achieve the proposed objective

These activities answer to the aim of the project, i.e. capitalisation updating and extension of the work

- Organisation of clusters on the use of modelling tools, analysis of passenger and freight transport, definition of policy measures, and opening of Europe
- Organisation of specialised workshops on these different topics open to researchers, operators and decision makers
- Organisation of bilateral meetings with different national administrations, which will take the form of visits to different national administration as already envisaged in the THINK UP thematic network.
- Website and dissemination.

4. Expertise needed to achieve the objective

The network will be an extension of the existing network, and regroups researchers from different disciplines. The core group will be an extension of THINK UP group to put the focus on:
• Modelling tools
• Passenger transport
• Freight transport
• Policy analysis
• Enlargement of EU
• Mediterranean opening
IV – RESULTS AND CONCLUSION

There are two ways of reporting for the results and conclusions of THINK UP thematic network. On the one hand there are the results and conclusions of each work package in the domain they were assigned, for freight and passenger segmentation, for the introduction of policy variables in mobility predictions, and for the use of modelling tools which estimate the trends.

But, on the other hand, there are also the results obtained from the interactions between work packages to provide the general overview of what has been called “a common platform of understanding of transport trends”, and to identify what has been re-termed “sensitive” and “insensitive” market (they were called initially “core” and “competitive” segments) as regards modal shift and possibilities to influence this model equilibrium through policy measures. Finally THINK UP consortium participated actively to the projections realised by EXPEDITE consortium which was closely associated to THINK UP work and could directly put into practice the main outputs of THINK UP discussions.

All these aspects cannot easily be dissociated; specific meetings with experts in the different fields mentioned, have been combined with joined sessions and seminars open to a larger audience in order to achieve a comprehensive approach and strengthen a consensus on results.

During the lifetime of the project there has been indeed a very active participation of representatives of different national ministries, taking part, most of the time, to different meetings so that the consensus could be built on a longer period, which was necessary for consolidation of methodologies, as well as active participation of many professionals and researchers of European countries.

Concerning the segmentation of transport market different steps have been defined, in parallel, for freight and passenger focussing respectively on demand factors, supply factors as well as on the evolution of these factors. In most of
previous researches demand factors have often be privileged, thus underestimating the influence of supply determinants, related to different transport operating systems and limiting the understanding of the supply influence on modal equilibrium. The most significant changes in behaviour and influence of technologies were also taken into account, in order to provide a dynamic picture of transport trends, which, in turn, pointed out the fact a market segment cannot be qualified once and for all as “core” or “competitive”, as regards one or different modes of transport.

For both passengers and freight a segmentation was proposed, which can be “manageable” by policy makers and modellers; this meant in particular a number of segments which should not exceed fifteen or twenty segments, for passengers or freight. But this meant also the results of segmentation according to a hierarchical scheme so that one could always proceed at different levels of details.

The sequence of the workshops was organised in a way which is consistent with this methodological choice:

- First make a segmentation from the user point of view according to travellers and trips characteristics
- Then a segmentation from the service provider point of view who appreciates how his services can better fit to transport demand needs, at the present time and in the future
- And finally a consolidation of the segmentation through a cross segmentation, taking into account the interactions between demand and supply requirements.

For freight it appeared that the classical distinction between types of products is not relevant any more. Segmentation must privilege the type of logistic chain which is not reflected properly through the sole identification of the type of product. New factors such as shipment size and operating constraints of transport
companies need to be introduced early in the segmentation process rather than to
detail segments by types of product.

There is a transport logistic approach of the problem which differs from one mode
to another because of technical characteristics of the modes. For the final user
there are industrial logistic constraints, as well as distribution constraints of the
products; from that point of view influence of large distribution companies,
increasing their mastery on the whole transport system, must also be taken into
account.

This analysis of variables relative to chain organisation appeared to be the only
way to introduce properly intermodal transport chain in the modal choice debate.
Intermodal transport is also a priority for policy makers in order to enhance
alternative modes to road. However an intermodal transport chain is often difficult
to identify in the relation with a single mode in particular when maritime
alternative solutions develop in European transport in parallel with combined rail-
road transport solution.

A second important distinction stressed for freight is the spatial dimension,
whether transport is organised at regional, interregional, or eventually at
international level. Different spatial levels refer also to different institutional
settings which are also of particular importance for the organisation of passenger
transport.

For passenger segmentation discussions in the THINK-UP events have underlined
that the passenger transport market has been becoming more and more volatile
and complex. This has been caused by various evolutions on the demand and the
supply side.

Especially the tourism market segment is an extremely volatile market with
demand structures being very difficult and challenging to predict. The growing
number of holidays and leisure trips per household per year and shorter duration of holiday trips underline this development.

There are other factors for growing volatility of the trips such as more flexible working time, choice of destination subject to fashion, increased opportunities of travelling in parallel with increase of leisure time and household income. The fact that the population is ageing is also an important factor, with an increasing number of well-off and mobile elderly people.

In front of demand trends, the supply side has also encouraged the volatility of trip making with more and more specialised tour packages, provision of last-minute offers, multiplication of exotic destinations and the use of new information technologies, especially of the Internet, for reservation.

These evolutions have gone in parallel with the generation of more complex trip chains with in particular, the combination of business and leisure trips; pre-commitments are not restricted any more to car-ownership and the use of daily or monthly tickets in public transport has also a major impact on behaviours of travelling.

Again, the results obtained for passenger segmentation have provided a new understanding of the competition between modes, taking into account the new dimensions of the problem making the analysis more complex with the introduction of the concept of passenger “chains” of transport. A proposal of a segmentation grid crossing trip characteristics and user characteristics with supply characteristics has been proposed. Special attention was given to segments where competition between high speed rail and air develops, and to urban areas where competition exists between use of passenger car and public modes.

Finally THINK-UP sessions on passenger transport markets have also emphasised that, in order to achieve relevant modal shifts, a holistic approach has to be applied, which combines classical transport policy measures with “soft measures”,

Think Up Final Report
like awareness-arising campaigns, in order to make individuals’ thinking about mobility in general and to influence individuals’ images of modes and perceptions. Particularly for the competitive field of passenger transport in urban areas it is crucial that public transport operators provide sufficient information on public transport services and apply a user-friendly and easy-to-understand tariff system. This implies that political efforts have to go hand in hand with resolute efforts by transport service providers. Especially marketing and public relations department of transport operators plays an important role in contributing to a change in individuals’ images and perceptions of modes and of providing enough and reliable information on both services and tariffs.

The problem of selection of policy variables for mobility predictions raised first questions about the policy context, the choice of priorities and the available relevant policy measures in order to reach the assigned goals and in particular the re-equilibrium between modes. However the debate could be limited to the transport domain and the impact of non-transport policies on the transport sector was stressed for understanding past evolution and predicting the future.

Another important topic debated was the introduction of policy variables in models, the assessment of their impact and the interpretation of the results; this is all the context of “strategic assessment and modelling” stressing the possibilities and limits of the transport models which are available. In general the outcome or impact variables estimated in transport models are quite limited and a minimum set of policy variables, selected according to policy objectives, have to be considered in the modelling scheme, in parallel with the introduction of the “external forces driving structural changes” (the EDSC’s).

In this context the definition of “common scenario” is essential and often a prerequisite for a common understanding or appraisal of policy effects. In THINK UP a major distinction was made between “external” scenario variables related to socio economic environment and “transport policy” scenario. In the definition of scenario it is not enough to concentrate on macro-economic variables since other
variables, such as urbanisation, household income distribution, sectoral changes mediate the effects of factors driving the structural changes and considerably help understanding the dynamics of the interaction.

All these analysis have been useful to define inputs of the EXPEDITE prediction mode.

Concerning the choice of a model it first appeared that the diversity of models in Europe is not a problem as long as there is a good segmentation in the models in terms of the policy effects they encompass. For example there are 3 to 4 European models, one could take them as they are (and eventually use them combined and thereby observing the different reactions of these models) and define kind of “architecture” of models.

The review of the state of the art of projection tools was achieved through the presentation of these tools by their designer and users both for European and national models. A specific “task force” was set to deepen comparison of inputs and outputs of models with possible comparison between national models, and between national and European models results. Differences were pointed out between traffic reference data, scenario hypothesis both for socio economic and transport variables, which could partly explain differences between outputs for mobility predictions and modal shift estimations.

In proceeding so, it has been demonstrated that important progress can be made in a common understanding of the situation, stressing that use of different types of model can be more relevant for different types of analysis.

In the typology of models proposed it was showed how certain types of models will be better adapted to assess generation of traffic, geographic distribution, modal split or network assignment than others. This in turn gave a more appropriate understanding of the possibility to integrate specific policy variables in the projection process. All these analysis were conducted for passengers and
freight, for national and European models. However for passengers, focus was put on more national models, which results have been integrated in a meta-model developed by EXPEDITE more appropriate for short and medium distance travels than for longer distances where detailed specific information relative to competition between air and HST have to be introduced.

For freight such definition of a meta-model appeared more complex and SCENES model was used for predictions.

In conclusion important results concern remarks about a common use of different tools to improve common understanding, once harmonisation in scenario definition has been achieved. Again, THINK-UP conclusions of the workshops insisted on the need of a common set of data in Europe that can be used commonly in studies, with a set of workable scenarios relevant for the present European context. Then different models with the same set could be run and the differences of the models analysed; confrontation of different results can improve the understanding of alternative developments of the transport system. Once this is accepted, experts can have a similar framework of understanding, and it was agreed that there is no extreme apparent difference that would be an obstacle to a consensus.

The interest manifested by the national experts of the countries during THINK UP workshops and seminars, their reactions to the forecasts, their contribution confirm that Member States are demanding the possibility to present and compare their methods, results and questions. The modelling experience of Member States representatives and consultants revealed to be a crucial input in the discussions and should be used on a more permanent basis.

The THINK UP team recommends, in a longer term approach, the formation of a discussion platform, which might be a kind of continuation of the exchanges initiated in THINK UP workshops concerning in particular differences between European and national results.
This “common working model comparison platform” would avoid many future misunderstandings when looking for consensus in data, scenarios and market segment definition.

At the credit of THINK UP thematic network the efforts made for dissemination must also be stressed. Beyond a wide participation of national and European experts to workshop and seminars, the web site of THINK UP has registered many requests with, for example, more than 5 500 requests from France and 3 500 from Germany.
IV – RESULTS AND CONCLUSIONS OF THE PROJECT

There are then two ways of reporting for the results and conclusion of THINK UP thematic network. On the one hand there are the results and conclusion of each work package in the domain they were assigned for freight and passenger segmentation, the introduction of policy variable in mobility predictions and the use of modelling tools for estimation of trends.

But, on the other hand, then the results and conclusion obtained from the interaction and confrontations of the analysis developed in each work package to provide a general overview of what has been called a common platform of understanding transport trends, in identifying what has been re-termed sensitive and insensitive market segments as initially formulated) as regards modal shift and possibilities to influence this model equilibrium through policy measures, and finally to actively participate to the definition of concrete projection exercise, in close relation with EXPEDITE project which was closely associated and could directly put into practice the main outputs of THINK UP discussions.

Both aspects cannot easily be dissociated; specific meetings with experts in the different fields mentioned, have been combined with joined sessions and seminars are open to a large audience in order to achieve a comprehensive approach and strengthen a consensus on results.

During the lifetime of the project there has been a very active participation of representatives of different national ministries, taking part, most of the time, to different meetings so that the consensus could be built on a longer period which was necessary for consolidation of methodologies and deepening of the initial understanding, as well as active participation of many professionals and researchers of European countries, as well as some of Mediterranean countries.
Concerning the segmentation of transport market different steps have been defined in parallel for freight and passenger focussing respectively on demand factors, supply factors as well as on the evolution of the demand and supply factors. In most of previous researches demand factors have often be privileged, thus underestimating the influence of supply constraints related to different transport operating systems and limiting the understanding of the supply influence on modal equilibrium and market segments sensitivity to modal shift. The most important changes in behaviour for demand and technologies for supply were also taken into account, in order to provide a dynamic picture of transport evolution, which, in turn, pointed out the fact a market segment cannot be qualified a priori as “core” or “competitive”, as regards one or different modes of transport.

For both passengers and freight a segmentation was proposed, which can be “manageable” by policy makers and modellers ; this meant in particular a number of segments which should not exceed fifteen or twenty segments, for passengers or freight, but which meant also the presentation of a hierarchical scheme of this segmentation so that one could always proceed at different levels of details.

The organisation of the workshop was made accordingly to this methodological choice :

- First make a segmentation from the user point of view according to travellers and trips characteristics
- Then make a presentation from the service provider point of view who appreciates how his services can better fit to transport demand needs, at the present time and in the future
- And finally consolidate a cross segmentation which improved the understanding of the interactions between demand and supply requirements, within a time scale perspective.

For freight it appeared that the classical distinction between type of products is not relevant any more. Segmentation must privilege the type of logistic chain
which is often not any more reflected properly through the sole identification of the type of product. New factors such as shipment size and operating constraints of transport companies imposed by rolling stock management, need to be introduced early in the segmentation process rather than to segment further the type of product.

There is a transport logistic approach of the problem which differs from one mode to another because of technical characteristics, and there are for the final user industrial logistic constraints, as well as constraints in the distribution of the products with more and more influence on large distribution, increasing their mastery on the whole transport system.

This analysis of variables relative to chain organisation appeared to be the only way to introduce properly intermodal transport chain, which is a priority for policy makers in order to enhance alternative modes to road; an intermodal transport chain is often difficult to identify in the relation with a single mode in particular when maritime alternative solutions are becoming more and more important for European transport future and not only combined transport solution.

A second important distinction for freight is spatial dimension, whether transport is organised at regional, interregional, or eventually at international level, whether there exists alternative routes by sea or inland waterways. These different spatial levels have shown in the past quite different transport trends and modal shares. This spatial dimension segmentation will help considerably for the understanding of perspective for intermodal transport, as well as for the identification of the type of policy measure which is more adequate in transport choice, since different spatial levels refer to different institutional settings. At that stage freight segmentation interrelates with the transport policy analysis as well as the choice of modelling tool, pointing for a more intensive use of the GIS in network assignment in order to understand the choice of a mode or a sequence of modes.
In conclusion for freight segmentation of the market, there has been investigations in new dimension which appeared relevant for the purpose of THINK UP keeping in mind the necessity to bring an applicable solution, with a desegregation from three (bulk, unitised, general cargo) up to fifteen or twenty types of segments.

For passenger segmentation presentations and discussions on the THINK-UP events have underlined that the passenger transport market has been becoming more and more volatile and complex. This has been caused by various evolutions on the demand and the supply side.

Especially the tourism market segment is an extremely volatile market with demand structures being very difficult and challenging to predict. The growing number of holidays and leisure trips per household and year and shorter duration of holiday trips underlines this development.

There are different factors for growing volatility of the trips such as more flexible working time, choice of destination subject to fashion, increased opportunities of travelling in parallel with increase of leisure time and household income. The fact that the population is ageing is also an important factor, with an increasing number of well-off and mobile elderly people.

In front of demand trends, the supply side has encouraged volatility of trip making; more and more specialised tour packages, provision of last-minute offers, multiplication of exotic destinations with the use of new information technologies especially of the Internet.

These evolutions have gone in parallel with the generation of more complex trip chains with in particular, the combination of business and leisure trips; recommitments are not restricted any more to car-ownership and the use of daily or monthly tickets has also a major impact on behaviours of travelling.

Again as far as freight segmentation, the results obtained provided a new understanding of the competition between modes, taking into account the different
dimensions of the problem which do influence model equilibrium, but also making the analysis more complex with, in particular, the introduction of passenger “chains” of transport. However the objective set for application of the segmentation and production of trends per segments has lead to a proposal of a concrete segmentation grid crossing trip characteristics and user characteristics with supply characteristics. Special attention has been given to specific segments when competition between high speed rail and air develops, and to urban areas with competition between use of passenger car and public modes. Consequences for transport modelling have been stressed.

Discussions and presentations on THINK-UP events on passenger transport markets have also emphasised that, in order to achieve relevant modal shifts, a holistic approach has to be applied, which combines classical transport policy measures with “soft measures”, like awareness-arising campaigns, which aim at making individuals’ thinking about mobility in general and at influencing individuals’ images of modes and perceptions. Particularly for the competitive field of passenger transport in urban areas it is crucial that public transport operators provide sufficient information on public transport services and apply a user-friendly and easy-to-understand tariff system. This implies that political efforts have to go hand in hand with resolute efforts by transport service providers. Especially marketing and public relations department of transport operators plays an important role in contributing to a change in individuals’ images and perceptions of modes and of providing enough and reliable information on both services and tariffs.

The problem of selection of policy variables for mobility predictions raised questions about the policy context, the choice of priorities and the available relevant policy measures is to reach the assigned goals among which the re-equilibrium between modes which was the focus of THINK UP; However the debate cannot be limited to the transport domain and the impact of non-transport policies on the transport sector was stressed for understanding past evolution and
predicting the future; the possible role of technical innovations has also to be taken into consideration in the definition of policies.

However another important aspect of this topic was also to assess, concretely, how the policy variables are introduced in models, how their impact is estimated, and how the results are interpreted; this is all the context of strategic assessment and modelling being aware of the possibilities and limits of the transport models which are available. In general the outcome or impact variables estimated in transport models are quite limited and a minimum set of policy variables, selected according to policy objectives, have to be integrated in the modelling scheme, in parallel with the introduction of “external forces driving structural changes” (the EDSC’s).

Therefore the definition of common scenario is essential and often a prerequisite for a common understanding or appraisal of policy effects. In THINK UP a major distinction was made between external scenario variables related to socio-economic environment and transport policy scenario and these analysis have been used to define inputs of the EXPEDITE prediction model. But in the same time it is not enough to concentrate on macro-economic variables and other variables such as urbanisation, household income distribution, sectoral changes mediate the effects of factors driving the structural changes and help understanding the dynamics of the interaction.

In conclusion, one can at this stage say that the diversity of models in Europe is not a problem as long as there is a good segmentation in the models in terms of the policy effects they encompass. For example there are 3 to 4 European models, one could take them as they are (and eventually use them combined and thereby observing the different reactions of these models) in a kind of architecture.

Concerning the projection tools a review of the state of the art was achieved through the presentation of these tools by their designer and users both for European and national models. A specific “task force” was set to deepen
comparison of inputs and outputs of models with possible comparison between national models, and between national and European models; differences were pointed out between traffic reference data, scenario hypothesis both for socio economic and transport variables, which could partly explain differences between outputs for mobility predictions and modal shift estimations. In proceeding so, it has been demonstrated that important progress can be made in a common understanding of the situation, stressing that different types of model can better fitted for different types of analysis.

In this review of the models a typology was made showing how certain type of models will be better adapted to assess generation of traffic, geographic distribution, modal split or network assignment than others, which in turn give a more appropriate understanding of the possible integration of specific policy variables in the models. This was done for passengers and freight, for national and European levels of analysis. For passengers focus was put on national models, which results could be better integrated in a meta-model developed by EXPEDITE; in doing so results were probably more appropriate for short and medium distance travels than for larger distance travels where specific information relative to competition between air and HST has to be introduced.

For freight the situation appeared more complex and SCENES model was used for prediction.

However the results were not limited to protection of trends in relation with EXPEDITE and to review of models. Important results concern remarks about a common use of different tools to improve common understanding, once harmonisation in scenario definition has been achieved. Again, the workshop insisted on the need of a common set of data in Europe that can be used commonly in studies, with a set of workable scenarios and their assumptions specified for a European context. Then different models with the same set could be run and the differences of the models be analysed; confrontation of different
results can improve the understanding of alternative developments of the transport system.

Once this is accepted, experts can have a similar framework of understanding, in other words, there is no extreme apparent difference that would be an obstacle to a consensus.

Similarity between transport aggregated data can hide huge differences within the segments of transport, and make a policy successful or not.

As the moment SCENES model is chosen as a standard forecasting instrument by the EXPEDITE project, the question is not to make it converging but just to use the differences with other sources to come to a common understanding of trends.

The interest manifested by the national experts of the countries for the workshop presentations, their reactions to the forecasts, their conclusions, all of them are a signal that Member States are demanding a possibility to present and compare their methods, results and questions. Modelling experience of Member States representatives and consultants reveals to be a crucial input in the discussions and should be used on a cooperative and continuous way.

The THINK UP team recommends, in a longer term approach, the formation of a discussion platform, which might be a kind of continuation of the exchanges of such a THINK UP workshop on differences between European and national results.

This “common working model comparison platform” would avoid many future misunderstandings by focusing on such data, scenarios and market segment indicators.
## List of workshops and seminars

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Type</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 2000</td>
<td>Seminar</td>
<td><strong>Review of National and European Models</strong></td>
</tr>
<tr>
<td>Dec 2000</td>
<td>Workshop</td>
<td><strong>Segmentation of Passenger Transport Markets - users</strong></td>
</tr>
<tr>
<td>Dec 2000</td>
<td>Workshop</td>
<td><strong>Segmentation of Freight Transport Markets - users</strong></td>
</tr>
<tr>
<td>Dec 2000</td>
<td>Workshop</td>
<td><strong>Segmentation of Passenger Transport Markets - service providers</strong></td>
</tr>
<tr>
<td>Dec 2000</td>
<td>Workshop</td>
<td><strong>Segmentation of Freight Transport Markets - service providers</strong></td>
</tr>
<tr>
<td>Dec 2000</td>
<td>Workshop</td>
<td><strong>Setting the policy context</strong></td>
</tr>
<tr>
<td>Mar 2001</td>
<td>Workshop</td>
<td><strong>Passenger - Cross Segmentation</strong></td>
</tr>
<tr>
<td>Mar 2001</td>
<td>Workshop</td>
<td><strong>Freight - Cross Segmentation</strong></td>
</tr>
<tr>
<td>Jun 2001</td>
<td>Seminar</td>
<td><strong>Passenger and Freight Market Segmentation</strong></td>
</tr>
<tr>
<td>May 2001</td>
<td>Workshop</td>
<td><strong>Interactions : Policy and Transport Systema</strong></td>
</tr>
<tr>
<td>May 2001</td>
<td>Workshop</td>
<td><strong>Transport Policy &amp; Mobility Prediction</strong></td>
</tr>
<tr>
<td>Jun 2001</td>
<td>Workshop</td>
<td><strong>Integration of the supply and demand factors</strong></td>
</tr>
<tr>
<td>Nov 2001</td>
<td>Seminar</td>
<td><strong>Definition of the policy variables</strong></td>
</tr>
<tr>
<td>Jan 2002</td>
<td>Workshop</td>
<td><strong>Review of interzonal and national model runs</strong></td>
</tr>
<tr>
<td>Sep 2002</td>
<td>Workshop</td>
<td><strong>Response to EXPEDITE forecasts and other model results as regards model specification</strong></td>
</tr>
<tr>
<td>Oct 2002</td>
<td>Final Seminar</td>
<td><strong>Potentials for Modal Shift : A segmented Approach for the European Transport Market</strong></td>
</tr>
</tbody>
</table>
V – REFERENCES


Czyzewski, A., Orlowski, W.; Zienkowski, L.; Szimba, E. (eds.): *Drivers of Transport Demand -Central and Eastern European Countries (CEEC)*. Deliverable D3b of the SCENES project funded by the European Commission (DG TREN). May 2000, Karlsruhe. This Deliverable in available in the Internet: [http://www.iww.uni-karlsruhe.de/SCENES](http://www.iww.uni-karlsruhe.de/SCENES)


Rothengatter, W.; Schaffer, A.; Szimba, E.; Bristow, A.; Matthews, B.; Ortmann, C. (eds.): *Drivers of Transport Demand -Western European Countries-.* Deliverable D3a of the SCENES project funded by the European Commission (DG TREN). April 2000, Karlsruhe. This Deliverable is available in the Internet: [http://www.iww.uni-karlsruhe.de/SCENES](http://www.iww.uni-karlsruhe.de/SCENES)


