Index

YEAR XIV, NUMBER 38, April 2008

European Transport \ Trasporti Europei n. 38 (2008): 1-16

A complete methodology for the quality control of passenger services in the public transport business

Yannis Tyrinopoulos [1*], Georgia Aifadopoulou [1]

[1] *Hellenic Institute of Transport / Centre for Research and Technology Hellas*
Thessaloniki, Greece

Abstract

The quality of the services provided to the passengers is synonymous with a wide range of characteristics of the transportation system, such as safety, on-time performance, accessibility, efficiency, and many others. Today, more and more public transport operators and associated bodies (e.g. ministries and supervising organizations) worldwide invest in quality control programs in order to assess and improve the services provided to the passengers. The paper provides an overview of the Methodology developed by the Hellenic Institute of Transport to assess the levels of quality and performance of public transport services. Key results from the application of this Methodology to the major public transport organization in Greece (OASA) are provided as a case study.

Keywords: passenger transport, public transport, service quality, customer satisfaction

1. Introduction

Among the prime goals of all actors involved in the public transport business is the creation of a well-organized transit system, within which citizens can find a sufficient level of mobility and satisfy their important need for the efficient movement under safe and comfortable conditions. This overall principle entails many significant quality characteristics of the public transport system, such as safety, on-time performance, accessibility, efficiency, information provision and many others.

The quality in public transport stems from the ability of the respective operators to manage and to further develop their services. Even more and more relevant operators and associated bodies (e.g. ministries and supervising organizations) worldwide employ *quality control programs* in order to assess and improve the services provided to the passengers (PORTAL, 2003) (QUATTRO, 1998) (EQUIP, 2000). The backbone of these programs is a variety of quality attributes and indices that assess the levels of the services provided to passengers and the performance of the transportation system

* Corresponding author: Yannis Tyrinopoulos (ytyrin@certh.gr)

(Giannopoulos, 1989). Furthermore, such programs provide operators strategic tools that enable them to be closer to passengers and adjust the transportation service to their needs and requirements, while the knowledge gained from these programs feed with valuable data and facilitate their decision making process (Tyrinopoulos, et al., 2004).

In metropolitan areas with complex transportation systems managed by multiple operators (such as London, Athens, Rome and others), the implementation of quality control programs seems to be an integral part of their business operation. In some major cities, like London and Rome, the quality control is a daily practice (London Buses, 2004) (TRAMBUS, 2003). In many cases, the results of this practice define the contract rules between supervising and subsidiary organizations, the scheduling of the transportation system and the decision making process itself. Nowadays, many large and medium size public transport organizations and operators apply quality control systems, accompanied with scientific and technological aid. In the long run, such initiatives may contribute to attract more customers and facilitate the economic viability of transit organizations.

The Hellenic Institute of Transport (HIT), the body devoted to the promotion and execution of transport in Greece, provides consultation services to many transport organizations. Public transport is one of the transport sectors, where HIT possesses significant expertise and experience. Addressing the great demand nowadays in Greece for the assessment of the levels of quality and performance of public transport services, the researchers of HIT have developed a complete Methodology that has been adjusted and applied to the major urban and interurban public transport organizations in Greece, the Athens Urban Transport Organization (OASA), the Organization of Urban Transport of Thessaloniki (OASTh) and the Hellenic Railways Organization (OSE).

The purpose of this paper is to present an overview of this Methodology with its main elements, the indicators used for transit quality and performance assessment, examples of the indicators' calculation (mathematical equations) and sampling considerations. Furthermore, key results from the application of the Methodology to the major urban public transport organization in Greece (OASA) are provided as a case study. The benefits for the transit organizations that will adopt the Methodology are also discussed.

2. Presentation of the Methodology

2.1 Methodology development and adjustment

The Methodology developed by HIT has been inspired by the need to give to public transport organizations an operational and strategic tool capable of monitoring and assessing different aspects of the services provided to passengers. It addresses the quality of transit services and the operational performance of the transportation system (terminals, stop points, vehicles, etc.), while it does not cover aspects related to infrastructure, organization and economics.

The initial development of the Methodology and its adjustment to a particular transit environment/operator is a three-phase process composed of the following activities:

A. Generic Methodology development

This first phase aimed at developing the generic Methodological Framework to be further customized to and used by the public transport system under assessment. This Framework includes quality and operational attributes and criteria, sampling considerations, data collection methods, data analysis techniques, procedures for the surveys organization and other elements that should be adopted and followed to achieve a sound depiction of the existing situation (levels of services quality and transit system operational performance) and to set the foundations for the effective monitoring of the services quality in the future. Two are the activities that took place in this phase:

1. Bibliographical review (standards, indicators and methodologies)

In the international bibliography, someone will meet indicators of various types (quality, operational, performance, etc.) that aim to assess different aspects of the transportation system (infrastructure, services, organization, etc.). The aim of this task was to identify and advise the standards and the methodologies that are currently available and documented in the international bibliography with regard to quality indicators of the passenger services.

2. Existing knowledge and experience

The researchers of HIT involved in this initiative possess the necessary know-how and expertise that led to the development of the generic Methodological Framework. It is very important the fact that, through its long provision of many consultation services, HIT has an excellent knowledge of the Greek public transport system allowing a straightforward and effective customization of the generic Methodology to the particular needs and priorities of the transit operators.

B. Methodology adjustment

This phase entails the adjustment of the generic Methodology to the public transport system to be assessed. It includes a series of activities that allow the development of a Methodology totally customized to the needs and priorities of the transit operators, as well as to the requirements of the passengers that use this transit system. This phase includes four activities:

1. Needs and priorities of the transit operator

An activity of primary importance is the sound identification of all attributes of the local transit system. Although a basic knowledge might exist, each transit operator has its own characteristics and particularities that require different approach. The goal is to collect and analyze all the necessary information about the network, the infrastructure and any other operational element that will shed light to the transit services.

2. Analysis of the experience of similar European organizations

It is advisable to take advantage of the experience of similar public transport organizations with long experience in the implementation of quality control programs. In the context of two such programs HIT implemented on behalf of the Athens Urban Transport Organization and Thessaloniki Transport Authority, HIT visited two

European transit organizations (Transport for London and ATAC (Rome)). These are organizations with extensive experience in quality indicators (e.g. London) and manage the transportation networks of cities similar to those of Athens/Thessaloniki (e.g. Rome). The know-how and experience of these organizations provided valuable information for the quality control programs applied to Athens and Thessaloniki.

3. Customer satisfaction/dissatisfaction survey

A customer satisfaction/dissatisfaction survey is another important activity that should be conducted in order to identify the priorities, expectations and degree of satisfaction of the passengers regarding the transportation services. In such surveys, the passengers provide the importance and satisfaction given in a series of quality and operational attributes of the transportation system, and by applying the appropriate methods (e.g. Quadrant analysis) the study team is able to derive those attributes that are important and do not perform satisfactorily, always according to the passengers' opinion.

4. Pilot Quality Control Program - Quantification of indicators of high priority

An activity that can be proved fundamental for the solidarity and comprehensiveness of the final Methodology is the quantification of specific indicators that are of high priority for the local transit operator. This is a kind of pilot program and upon conclusion, the study team can make an appraisal of the methodology applied and the results of the priority indicators in order to make adjustments and refinements for the future quantification of these and other indicators.

C. Adjusted Methodology Handbook

The above four activities lead to the development of a complete Handbook for the full-scale implementation of the Methodology, based on which the public transport organizations can schedule and apply their quality control programs. Major components of this Handbook are:

- *Detailed description of the indicators*
- *Mathematical equations*
- *Sample determination*
- *Procedures for the surveys organization*
- *Needs in human resources mobilization*
- *Data collection methods*
- *Questionnaires and other documents/matrices*
- *Time plan for the surveys implementation*
- *Statistical methods (e.g. factor analysis and ordered logit modelling) for further analysis of the data to facilitate the decision making process*

The overall approach described above is illustrated in figure 1.

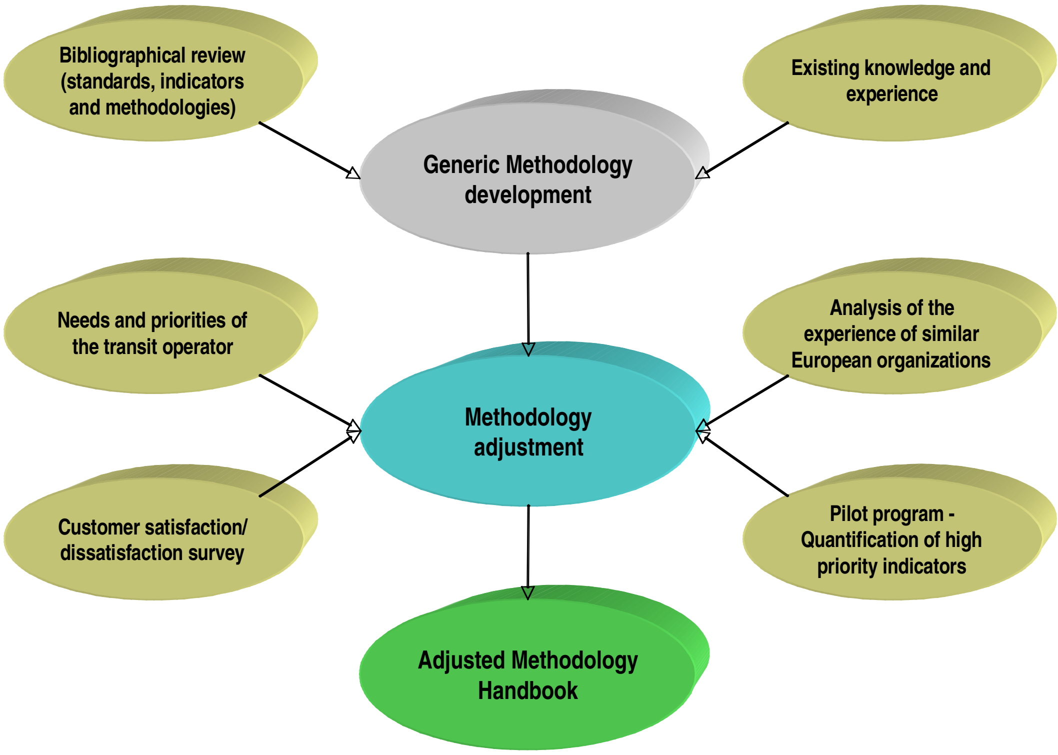

Figure 1: Methodology development and adjustment process.

2.2 Overview of the indicators

The proposed Methodology contains 39 indicators classified in seven major categories:

A. Safety – Comfort – Cleanliness: it entails quality attributes related to the infrastructure of the public transport operator and more particularly to the safety of the journeys, safety at the stop points and terminals, comfort during the journeys execution onboard the vehicles, cleanliness of the vehicles, stops and terminals.

B. Information – Communication with the passengers: it entails attributes related to the quality, comprehensiveness and timeliness of the information provided to the passengers for all aspects related to the transportation service and the means used for the communication of this information.

C. Accessibility: it contains quality attributes related to the ease accessibility of the vehicles, stop points and terminals by all categories of the population in general and the mobility impaired people in particular.

D. Terminals and stop points performance: it includes attributes related to the execution of the vehicles schedule, as well as additional parameters concerning the time dimension of the services provided at the terminal stations and stop points (e.g. on-time performance).

E. Lines performance: it includes attributes related to the performance of the lines/routes and the vehicles that serve them. The vehicles load, the vehicles average speed and the journeys' run times are among the indicators included.

F. General elements of the public transport system: it entails quality attributes not included in one of the above four categories and concern the wider transportation system and the services provided by the public transport operator. Quality parameters to be assessed are the fare and ticketing system, service provision hours, bus lanes, etc.

G. Compound indicators: it entails a number of compound indicators calculated based on the results of the indicators of the previous five categories. These compound indicators give a consolidated picture of the performance or satisfaction/ dissatisfaction of specific quality parameters (e.g. vehicles scheduling).

Each of the above categories contains two or more indicators. These indicators are of three types: either qualitative indicators (pure quality factors), either operational-performance indicators (addressing the operational dimension of the transportation system) or both. Table 1 presents the 39 indicators.

Special reference has to be made to the Compound indicators of category G. The individual indicators that compose the compound indicators are appropriately combined using weights to estimate the overall service level. The selection of weights has been made as follows:

> *Indicator G.1 "Customer satisfaction/dissatisfaction"* is calculated based on the values of the qualitative indicators of the previous categories, such as Safety conditions onboard the vehicle (A.2), Attitude of the personnel (A.3), Lines frequencies (E.5) and Current information provision about the transportation service (B.1). The weight assigned to each individual indicator is derived from the importance given by the passengers during the pilot Customer satisfaction/ dissatisfaction survey described above to specific quality and operational attributes of the transportation system (3rd Activity in the Methodology adjustment). In this way, the Methodology has embedded the priorities of the passengers in the calculation of this user oriented compound indicator, thus contributing to more safe and reliable conclusions.

> *Indicator G.2 "Vehicles scheduling performance"* is calculated based on the indicators "On time performance at the terminal stations" (D.2) and "Relation between the executed headways and the lines frequencies at the stop points and terminal stations" (D.5). This compound indicator has been derived in consultation with the transit operators, where the Methodology has been adjusted and applied, providing a generic conclusion about the performance of the operators' scheduling program at terminals. Due to their nature and scope, the two individual indicators (D.2 and D.5) have equal weight.

Table 1: Overview of the indicators.

Code	Category / Indicator
A	**Safety – Comfort – Cleanliness**
A.1	Safety conditions at stops and terminal stations
A.2	Safety conditions onboard the vehicle
A.3	Attitude of the personnel
A.4	Vehicles, stops and terminal stations cleanliness
A.5	Easiness in the embarkation on/disembarkation from the vehicles
A.6	Criminality
A.7	Deaths and injuries
A.8	Incidents
B	**Information – Communication with the passengers**
B.1	Current information provision about the transportation service
B.2	Submission of complaints and advices by the passengers and reply of the transit operator
C	**Accessibility**
C.1	Ease accessibility to elderly and disabled persons
C.2	Distance between the origin point and the ticket selling point
C.3	Distance between the ticket selling point and the embarkation stop point
C.4	Distance and time between the interchange points
D	**Terminals and stop points performance**
D.1	Journeys execution at the terminal stations
D.2	On time performance at the terminal stations
D.3	Mean waiting time of the passengers at the stop points and terminal stations
D.4	Excessive waiting time of the passengers at the stop points and terminal stations
D.5	Relation between the executed headways and the lines frequencies at the stop points and terminal stations
E	**Lines performance**
E.1	Journeys run times
E.2	Average speed of the vehicles
E.3	Vehicles delay at the stop points
E.4	Vehicles load
E.5	Lines frequencies
F	**General elements of the public transport system**
F.1	Service provision hours
F.2	Waiting time for the issuing of cards
F.3	Waiting time for the purchase of tickets
F.4	Vehicles of all types operating in peak hours
F.5	Coverage of the network
F.6	Bus lanes violation
F.7	Types of tickets and cards available
F.8	Prices of tickets and cards
F.9	Sufficiency of the tickets selling network
F.10	Condition of the tickets issuing machines
F.11	Condition of the tickets validation machines
F.12	Condition of the stop points and the terminal stations with relation to the seats and shelters
G	**Compound indicators**
G.1	Customer satisfaction/dissatisfaction
G.2	Vehicles scheduling performance
G.3	Easiness in the tickets purchase and validation

> Finally, *indicator G.3 "Easiness in the tickets purchase and validation"* assesses the overall easiness of the passengers in purchasing and validating their tickets, and the effectiveness of the operator's ticketing network. This compound indicator combines all individual indicators related to the ticketing element of the transportation system, such as Distance between the origin point and the ticket selling point (G.2), Waiting time for the issuing of cards (F.2), Sufficiency of the tickets selling network (F.9) and Condition of the tickets validation machines (F.11). The weight assigned to each individual indicator is derived from the importance given to this transportation attribute by the passengers during the Customer satisfaction/dissatisfaction survey with some minor adjustments by the transit operator in question to address its particular characteristics, priorities and needs. Therefore, the weights calculation process has incorporated the unbiased opinion of the passengers, but also the particularities of the transportation network.

2.3 Examples of indicators calculation

A complete sub-methodology has been devised for the measurement of all 39 indicators. It contains specifications and mathematical equations for the calculation of the indicators, data collection techniques, etc. The mathematical equations of many indicators, mainly those addressing qualitative attributes of the transit service, are quite simple and straightforward. In other, however, indicators their estimation is more complicated and encompasses more complex queries and calculations. The mathematical equations for three representative indicators are provided below:

Excessive waiting time at the stop points and terminal stations

This indicator estimates the excessive waiting time of the passengers at the terminal stations or the stop points for their embarkation in the vehicles. The indicator is examined from the perspective of the transit operator and is calculated for each line, taking into account the outcome of the operator's scheduling process (scheduled headways) and the actual measurements on site (executed headways). The mathematical equation of the indicator is the following:

$D.4_i$: Excessive waiting time of the passengers at the terminal (or stop point) for their embarkation in the vehicles of line i

SW_i: Scheduled mean waiting time of the passengers at the terminal (or stop point) for their embarkation in the vehicles of line i

AW_i: Actual mean waiting time of the passengers at the terminal (or stop point) for their embarkation in the vehicles of line i

$$D.4_i = \frac{AW_i - SW_i}{SW_i} \qquad SW_i = \frac{\sum_{j=1}^{n}(sh_{ij})^2}{2*\sum_{j=1}^{n} sh_{ij}} \qquad AW_i = \frac{\sum_{j=1}^{n}(ah_{ij})^2}{2*\sum_{j=1}^{n} ah_{ij}}$$

Where,

sh_{ij} = all the scheduled headways of line i

ah_{ij} = all the actual (executed) headways of line i

Vehicles load

The indicator estimates the load of the vehicles during their daily operation and it is expressed as the number of passengers onboard divided by the capacity of the vehicles.

During journeys' execution, the members of the survey team onboard the vehicle (one in each door) count the passengers embarking on and disembarking from the vehicle. The analysis of the collected data mainly contains three results: maximum vehicles load (including the segments of the lines where the maximum load has been occurred), mean vehicles load and lines percentage where the load exceeds 1. The mathematical equation for the calculation of the maximum vehicles load is the following:
The first step is the calculation of the passengers onboard a vehicle per line segment (between two subsequent stop points):

$$P_i^j = P_{i-1}^j + E_{i-1,i}^j - D_{i-1,i}^j$$

Where:

P_i^j : passengers onboard the vehicle in segment i of line j

P_{i-1}^j: passengers onboard the vehicle in segment i-1 of line j

$E_{i-1,i}^j$: passengers embarking the vehicle in the stop point between the segments i-1 and i of line j

$D_{i-1,i}^j$: passengers disembarking the vehicle in the stop point between the segments i-1 and i of line j

The calculation of the maximum load is based on the sum of the passengers onboard the vehicles of all journeys examined per line segment separately. The segment with the maximum sum is the one with the higher load in the specific line. Therefore, the mathematical equation for the calculation of the maximum vehicles load in a particular line is the following:

$L_j^{\max}$: maximum vehicles load of line j

$$L_j^{\max} = \frac{\max(\sum_{z=1}^{n} P_i^{j,z}, \forall i = 1...m)}{\sum_{z=1}^{n} C^{j,z}} * 100\%$$

Where,

$P_i^{j,z}$ = passengers onboard the vehicle executing the journey z in the segment i of the line j

$C^{j,z}$ = capacity of the vehicle executing the journey z in the line j

Sufficiency of the tickets selling network

This is a qualitative indicator aiming to assess the sufficiency and effectiveness of the tickets selling network and the easiness to purchase tickets from the various selling points. The data collection for this indicator includes mystery-shopping surveys. The mystery-shoppers collect the following data for each selling point:

- Tickets availability.
- Existence of the special indication informing customers about the availability of tickets in this selling point.
- Position and visibility of the indication.

The analysis of the above data is quite straightforward resulting to the percentage and location of the selling points that do not have tickets to sell, the percentage of the selling points having the special indication and the percentage of the latter points, where the indication is clearly visible.

2.4 Sampling considerations

The sampling process refers to both the passengers and the transportation units (i.e. vehicles, terminals, lines, etc.). The determination of the sample size in the passengers' survey should take into consideration the spatial distribution of the population and the minimum sample per geographical area. Standardized statistical methods used for similar surveys must also be used. According to a well-known method (Johnson, Wichern, et al., 1992), the sample size (n) is calculated using the following equation:

$$n \geq N\left\{1+\frac{N-1}{P*(1-P)}\left(\frac{d}{z_{a/2}}\right)^2\right\}^{-1}$$

Where,

N = size of the population that in this case is the passenger traffic of the transit system
P = the quality characteristic to be measured (satisfaction); if no previous experience exists then the neutral situation (P=0,5) is considered
d = margin of error (5%)
$z_{a/2}$ = 1,64 for level of confidence 90%

Concerning the transportation units such as vehicles, terminals, lines, etc., the situation is much different. The transit operator wishes to take the most of such surveys and include in its quality control program the majority of the terminals, lines, stop points, etc. This is mainly the case and it is also feasible for small transportation networks (less than 50 lines). However, the experience gained from the use of the proposed Methodology to the largest Greek bus transit operator (ETHEL, see §3.2) and the review of the quality control programs applied to two European transit organizations (Transport for London and ATAC (Rome)), showed that in large transportation networks served by multiple operators (buses, tram, metro, etc.) with more than 300 lines, a sample size of 10-20% of the various units is capable of providing sound estimations and reliable conclusions. It must also be stressed that decisive factors in the selection of the transportation units' samples are the needs and priorities of the transit operator, as well as the available budget.

2.5 Statistical methods for data analysis

The measurement of the indicators presented previously does not require any particular statistical processing. The mathematical equation of each indicator can be calculated using simple data processing techniques and programs. However, additional elaboration may be needed when trying to derive useful information about the performance of the transit services and the customers' satisfaction to facilitate decision-making process.

A very interesting and useful for the transit operators information is the relation between quality of public transport service and customers' satisfaction. In that case, two statistical methods that could be used are factor analysis and ordered logit modelling. More particularly, the principal component factor analysis may be performed to reveal the common – hidden factors from the passengers' rating of the quality indicators satisfaction. Then, a multinomial logistic regression model can be developed for understanding and explaining the overall satisfaction of a customer. These two methods are proposed by the Methodology and are briefly explained below. The detailed description of these methods is beyond the scope of this paper, however more information can be found at the literature review (references) at the end of the paper.

Factor analysis

Factor analysis was developed in the early 20th century by Karl Pearson Charles Spearman with the intent to gain insight into psychometric measurements, in particular the directly unobservable variable intelligence (Johnson and Wichern, 1992). Factor analysis is based on a specific statistical model (Washington et al., 2003) and it is used to reduce the large number of qualitative attributes to a smaller number of factors for modeling purposes. Variables should be responded to on interval or quasi – interval scale (Likert, 1932). The first thing to do when conducting a factor analysis is to look at the correlation between variables. Various techniques to check data quality, the strength of the relationship among variables and the adequacy of each variable are used, while a rotation process is applied and a factor score coefficient matrix is produced at the final stages of factor analysis.

Multinomial logistic regression

In addition to the composite factors, operational indicators of the transportation system (calculated from onsite measurements to investigate the system's operational performance) are used to develop a multinomial logistic regression model in the attempt to investigate whether or not the operational indicators influence customers satisfaction (Ben-Akiva and Lerman, 1985). Multinomial logistic regression exists to handle the case of categorical dependents in order to determine the percent of variance in the dependent variable (overall satisfaction on the transportation system) explained by the independents (composite quality factors and operational performance) (Venables and Ripley, 2002).

3. Case study

As mentioned earlier, the generic Methodology described above has been adjusted and applied to the major urban and interurban public transport organizations in Greece, the Athens Urban Transport Organization (OASA) (HIT, 2004), the Thessaloniki Transport Authority (THETA) / Organization of Urban Transport of Thessaloniki (OASTh) (HIT, 2005) and the Hellenic Railways Organization (OSE) (HIT, 2004). In this chapter, the process followed for the Methodology adjustment and some indicative results from its application to OASA are briefly described as a case study.

3.1 Methodology adjustment

In 2003, OASA assigned to HIT, on a contract basis, the implementation of a quality control program with aims to assess the quality of the services provided to the users, to investigate the performance of the current transportation system and finally to formulate a complete Quality Control System that can be used in the future. This program with the generic Methodology adjustment contained three phases:

1. *The quantification of quality indicators that are of high priority for the transit operator*: Based on its needs and priorities, OASA in cooperation with HIT defined and calculated a small number of quality and operational indicators with individual measures, involving on-time performance, journeys execution at the terminal stations, vehicles cleanliness, bus lanes performance, tickets selling network performance and average speed of the vehicles.
2. *The development of the specifications for an integrated Quality Control System*: This phase included a customer satisfaction/ dissatisfaction survey, an extensive bibliographical review, visit to the public transport systems of London and Rome, benchmarking and an assessment of the methodology and the results of the indicators measured in the previous phase. These activities enabled the selection of indicators that in addition to the indicators defined in the 1st phase constituted the backbone of the Quality Control System of OASA. This phase concluded to the development of a handbook for the full-scale implementation Quality Control System in the future.
3. *The development of a software for the measurement of the indicators specified in the Quality Control System in the future*: This is an in-house application that is based on a relational database system, allowing a user friendly data import from various terminals inside or outside the organization, interfacing with existing files (e.g. time schedules), efficient and reliable indicators calculation, graphical and tabular presentation of the indicators values, comparisons between indicators and time-periods etc.

3.2 Profile of the survey

The study area includes the urban and suburban Athens with a population of close to 4,5 million citizens. At the time of the survey, the area was served by four transit operators:

> *Attiko Metro Operation Company (AMEL)*, a subsidiary of Attiko Metro S.A., with main objectives to organise, manage, operate and develop the underground railway network on lines 2 and 3, and any extension thereof within the Prefecture of Attica, as well as their facilities, vehicles, materials and media. The two metro lines operated by AMEL are integrated with the electric railway line (line 1) operated by ISAP (see below). Today, 23 Metro Stations are in operation at both METRO lines. These lines serve 650,000 passengers per day. The frequency of trips is every 3 minutes in rush hours and 5 to 10 minutes in non-rush hours. According to the European Performance Satisfaction Index (EPSI) Rating Institute (EPSI, 2005), AMEL has the highest customer satisfaction index compared with other means of public transport across Europe.

> *Company of Thermal Buses in Athens (ETHEL)*, which provides urban transport services with thermal buses in the Metropolitan area of Athens. The company serves 310 total bus routes and operates 16,000 trips daily, which represent 98.6% of all scheduled trips. This percentage is considered very high, given the constant deterioration of traffic conditions, as well as the continued decrease of the buses' average speed. ETHEL owns and operates a fleet of 2,099 buses. Currently, there are 1,822 buses in operation during peak hours.

> *Athens-Piraeus Trolley Busses (ILPAP)*, which operates an electric bus network (also called "trolley buses") of 22 lines that serve primarily the Athens and Piraeus city centers. Ten of these lines are being monitored by a telematic system. The company owns and operates a fleet of 315 single trolley buses (12m long) and 51 articulated trolley buses (18m long). The number of operated trolley bus trips per day is 1,943 (first semester 2005 average). The total number of trolley bus passenger trips in 2004 was 77 million.

> *Athens-Piraeus Electric Railways (ISAP)*, which operates the Electric Railway line that runs between Piraeus and Kifissia (metro line 1), serving 24 stations. The total length of line 1 is 25.6 km, while the total journey time (in one-direction) is 51 minutes. ISAP operates 607 trips daily. The maximum speed of the ISAP trains is 70 km/h. The total daily number of ISAP passenger–trips is currently 450,000. ISAP has currently 84 trains, which amount to 363 wagons.

The assessment of public transport services performance and quality in the study area mentioned above was based on two axes:

1. A customer satisfaction survey was conducted involving a number of service qualitative attributes (parameters). The list of attributes used was based to a large extent on the guidelines provided in the TRB (TRB, 1999) and other Handbooks and Manuals (CEN, 2002), following some adjustment to reflect existing conditions in the area and the particular characteristics of the local transportation system. The attributes finally selected were 20 and they cover a wide range of a public transport service, such as accessibility, safety, on-time performance, information provision, ticketing, frequency and many others. For each attribute, respondents were asked to put a score for satisfaction and importance.

The sampling procedure for this survey was carefully designed, taking into account the spatial distribution of the population and the minimum sample per geographic area. In this context, a sample of up to 400 passengers was considered to be satisfactory.

2. In parallel, certain operational attributes of the local transportation system were measured, through onsite and mystery shopping surveys, to assess the system's operational performance. These attributes involve vehicles load, average passengers waiting time at terminals and stops, on-time performance, average line speed and others. The surveys were conducted in 6 terminals, where the 78% of the total journeys is executed, in 33 bus stops and in 25 lines.

The data collected through the three different types of surveys, i.e. customer satisfaction, onsite and mystery shopping, was imported in a relational database and using the mathematical equations of the Methodology described earlier the values of the indicators were calculated.

3.3 Implementation outcome

The quality control program for THETA was successfully implemented and gave the organization valuable findings concerning the quality and performance of the transportation services provided to passengers, and moreover a tool that will allow the organization to maintain a complete monitoring and assessment quality control system in the future.

Although the values of the indicators measured are confidential information for OASA, the application of the quality control program showed that more coordination among the various transit companies at transfer points is required. This is quite expected, since currently six companies provide transit services to the residents in the Attica region. The passengers are somehow satisfied with the existing transit services and they focus the improvements on quality attributes comprised of prices, information provision, waiting and in-vehicle conditions, and accessibility. The results, however, differ according to the type of the transit company. For the transit company operating the metro system, for example, the high quality services are taken for granted and thus, customers emphasize on other quality attributes, such as the transfer coordination with other means and information provision.

On the operational aspect of the transit system, the performance of the services moves at satisfactory levels. This is an important finding, since the actual service frequency, for example, sometimes suffers, either due to the scheduled service limitations, or due to unforeseen external factors, such as congestion, vehicles breaking down, demonstrations or road maintenance blocking roads or strikes. The variety and complementarity of the operational attributes measured provided OASA very useful information that will enable the responsible officers to take the necessary measures to improve the transit service.

Finally, the three-phase process followed for the HIT's generic Methodology adjustment and implementation proved to be beneficial, since the indicators chosen and the tools employed for the data collection and analysis were capable of uncovering weak elements of the current transportation system and quality attributes that need special attention, and defining several measures that will shape a well coordinated and reliable transportation environment in the Attica region.

4. Conclusions

4.1 Methodology adoption

As in all cases, the proposed Methodology requires adaptation to the local characteristics of the transportation system under consideration. The indicators, the sample size, the surveys organization and other elements of the Methodology require customization to the size of the network, to the timetables of the transportation service and of course to the needs and priorities of the public transport operator or organization. The modular character of the Methodology and the associated software allows the implementation of parts of it.

The extensive know-how of the research team and the experience gained from the implementation of the Methodology to the various public transport operators mentioned earlier gave HIT the opportunity to establish a strong knowledge record and base in the field of quality control programs in the public transport business that could be applied to other transportation areas as well, such as Short Sea Shipping, intermodal urban transport and interurban bus transportation.

Two important characteristics of the Methodology that differentiate it from others and will encourage public transport operators to adopt it are:

1. It allows the estimation of the overall service level through the measurement of the appropriate compound indicators. This provides a consolidated picture of the performance or passengers' satisfaction/ dissatisfaction of quality services.
2. It facilitates the formulation of targets in service quality and performance based on the values of selected indicators and in consultation with the transit operator. Furthermore, it provides the necessary mechanisms and tools in order to investigate whether or not these targets have been reached.

4.2 Anticipated benefits

All medium and large size public transport organizations and operators worldwide take major initiatives at various levels (organizational, operational, technological etc.) towards developing a modern transportation scene, within which passengers can find an attractive, safe and efficient level of mobility. Especially in the last decade, most well organized public transport organizations have recognized that the Quality Control System should be one of such major initiatives.

The adoption of the proposed Methodology or a similar one by a public transport organization is undoubtedly a wise investment. In particular, the establishment and maintenance of such a Methodology will allow a public transport organization to:

- assess the performance of the transportation services;
- take measures towards services improvement;
- monitor the progress of the quality of its services in the future;
- better understand the needs and priorities of the passengers;

- establish an effective communication and cooperation channel between all parties involved in the local transportation system (operators, subsidiaries, ministries, municipalities, etc.);
- perform a customer-oriented scheduling process of the transportation service and internal operation of the organization; and
- support the decision making process of strategic character.

References

Ben-Akiva, M. and Lerman, S. R. (1985) *Discrete choice analysis*. MIT Press, Cambridge, MA.

EU 4th F.P. project EQUIP (2000) *Final Report – Annex: Practical Handbook*.

EU 4th F.P. project QUATTRO – Quality approach in tendering/contracting urban public transport operations, (1998) *Final Report*.

EU, RTD Programme Project PORTAL – Promotion of Results in Transport Research and Learning, (2003) *Final Report*.

European Committee for Standardization (CEN) (2002) *Transportation – Logistics and services – Public passenger transport – Service quality definition, targeting and measurement*.

Giannopoulos, G. A. (1989) *Bus planning and Operation in Urban Areas: A Practical Guide*.

Hellenic Institute of Transport, Stage 2 Final Report of the Project: An integrated quality control system for the public transport services in Thessaloniki (2005) *Application Manual of the Service and Performance Indicators*.

Hellenic Institute of Transport, Stage 2 Final Report of the Project: Integrated System for the Quality Assessment of the OASA passenger services (2003) *Handbook for the Implementation of the Quality Control System of OASA*.

Johnson, R. and Wichern, D. (1992) *Multivariate Statistical Analysis*. 3rd ed. Prentice-Hall, Englewood Cliffs, NJ.

Likert, R. (1932) *A Technique for the Measurement of Attitudes*, Archives of Psychology 140, 55.

London Buses (2004) *Customer Satisfaction and Mystery Traveler: Introduction: the Guide*. UK.

London Buses (2004) *Mystery Traveler Survey: Tramlink Report*. UK.

The European Performance Satisfaction Index (EPSI) Rating Institute (2005) *Customer Satisfaction Index 2005*.

TRAMBUS (2003) *Carta dei Servizi*. Italy.

Transportation Research Board (1998) *A Handbook: Integrating Market Research into Transit Management*, TRCP Report 37.

Transportation Research Board (1999) *A Handbook for Measuring Customer Satisfaction and Service Quality*, TRCP Report 47.

Transportation Research Board (2003) *A Guidebook for Developing a Transit Performance – Measurement System*, TRCP Report 88.

Transportation Research Board (2004) *Transit Capacity and Quality of Service Manual* (2nd Edition).

Tyrinopoulos, Y., Theologidou, M. and Aifadopoulou, G., (2004) *Quality Control Indicators for the passenger services provided by the Athens Urban Transport Organization (OASA)*. Proceedings of the 2nd International Congress on Transportation Research in Greece, Athens.

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S*. Fourth Edition. Springer. ISBN 0-387-95457-0.

Washington, S. P., Karlaftis, M. G. and Mannering, F. L. (2003) *Statistical and econometric methods for transportation data analysis*. Chapman & Hall/CRC.

Maritime interests and the EU port services directive

Athanasios A. Pallis [1], George-Spiros P. Tsiotsis [1*]

[1] *University of Aegean – Business School*
Department of Shipping, Trade and Transport
2 Korai St, 82100, Chios, Greece

Abstract

A key theme of the EU Port Policy has been the establishment of free market access to the provision of port services in EU ports. However, two successive European Commission proposals for a relevant EU port services directive (PSD) failed to produce a new policy regime. This paper examines the mobilisation of maritime interests, aiming to identify stakeholders' preferences and their contribution to the rejection of this port policy proposal. The analysis suggests that, although they did not share the same perspective, the views of organised maritime interests shared a common denominator: they were against the proposed EU rule due to its structural deficiencies. Assisted by the industrial heterogeneity, the difficulties to implement a 'one size fits all ports' policy, and the observed institutional tensions a variety of vested interests frequently with monopolistic positions contributed to the produced policy output failure.

Keywords: Intra-port competition; Port policy; Maritime interests.

---

1. Introduction

Following a lengthy consultation process, an overwhelming majority of the European Parliament (EP) voted, in January 2006, against the adoption of a European Commission proposal for a Directive aiming to establish free market access to port services, the so-called 'port services directive' (PSD). The paper analyses the role of maritime interests within this consultation process and assesses their contribution to this policy output failure.

This was the Commission's second unsuccessful attempt to establish a common European regulatory framework regarding the provision of port services in the major European ports. A narrow majority of the EP plenary session rejected the first proposal in December 2003. The almost immediate publication of a revised PSD proposal (PSD II) in October 2004 aimed to iron out the most controversial issues, yet the EP argued that this second proposal resembled the first one. Still, the EP reactions to the Commission's political manoeuvres can partially account for the produced output-

* Corresponding author: Athanasios A. Pallis (apallis@aegean.gr)

failure. This is because in both cases the EU-level interest groups representing stakeholders have been mobilised aiming to influence the policy-making process. Some of them united in seeking to preserve the status quo and did so successfully.

The search for a long-term EU Port Policy has been marked by the mobilisation of, and conflicts between, contending maritime interests, frequently with monopolistic positions (Baird, 1982; Pallis, 1997; Chlomoudis and Pallis, 2002). European Port Policy changes are the result of a dynamic process within which national governments and EU institutions need stakeholders' consensus to transform policy ideas to policy rules. Evidently, there are different opinions regarding several aspects of this policy, including the proposed PSD on port services liberalisation. Thus, the EU policy-making does not necessarily produce collective policy outcomes.

Via a comparative content analysis of their position papers published at various stages of the consultation process, the paper concludes with the contribution of maritime interests to the failure of translating the Commission's second proposal into an adopted EU port services directive. In Section 2, the paper briefly presents the content of the proposed port policy regime, while Section 3 discusses the observed institutional tensions between the Commission and the European Parliament regarding the prospect of converting this proposal into an EU policy. Section 4 analyses the stance of vested interests and the final Section presents the conclusions of this analysis.

2. The proposal for a Port Services Directive (PSD)

On November 20, 2003, the EP rejected the European Commission's first proposal on a PSD that would liberalise market access to port services, by a narrow majority (CEU, 2001). Within less than a year the Commission reintroduced the issue in the agenda of the EU port policy emphasising its intention not to abandon this effort. The PSD 'was complex, but necessary' (ESPO, 2004a); thus, in October 2004, it published a second proposal, the PSD II (CEU, 2004).

The initial proposal aimed at establishing open access on the basis of transparency, non-discrimination, and principles on issues like charging, public service obligations, as well as safety. Another objective was to assure that there were at least two service providers for each one of the three categories of port services: (a) technical-navigational services (pilotage, towage, mooring); (b) cargo-handling services (stevedoring, stowage, transhipment and other intra-terminal transport, storage, depot and warehousing); and (c) passenger services (embarkation, disembarkation).

The right to grant authorisations would be maintained by national governments, while the level of investment contemplated by the service provider would determine the maximum length of each authorisation. The aim was to ensure free competition within each port. In general, intra-port competition helps to eliminate any (private or public) strategy of price discrimination (i.e. according to demand elasticity) and monopolistic rent seeking. Inter-port competition also fosters specialisation (De Langen and Pallis, 2006a; Goss, 2006).

A further provision considered the right of port users to cargo self-handling. "Self-handling' is a situation in which an undertaking, which normally could buy port services, provides for itself, using its own land-based personnel and its own equipment, one or more categories of port services. Along with the liberalization of pilotage, these have been the most controversial issues within the EU decision-making process.

Following a lengthy consultation, the EU institutions detailed a compromise including: (a) the obligation of every port to submit information on its financial relations; (b) the obligation of newly authorised service providers to compensate former providers in those cases that the duration of their authorisation would be reduced; (c) the application of the rule in the case of pilotage according to safety criteria and public service requirements; and (d) the conditional permission of self-handling. Still, the European Parliament rejected this agreement (November 2003). This rejection was portrayed as a triumph by a heterogeneous spectrum of stakeholders ranging from dockers to some private ports (Psaraftis, 2005).

The revised PSD proposal was very similar on the grounds of definitions, scope, and objectives, (i.e. selection procedures for authorisations, neutrality of competent authority in selection, limitations, provisions for pilotage, financial transparency issues), with the exception of self-handling. The spirit of change could be found in the strictness and the mandatory character of the regime regarding authorisations, shorter maximum durations for each authorisation, and a new and broader definition of self-handling (Pallis and Vaggelas, 2005).

The directive would apply to any EU port, provided that its average annual throughput over the last three years has not been under three million tonnes or 500.000 passenger movements. In cases of ports reaching the freight traffic threshold without reaching the corresponding passenger movement one, the provisions of the Directive would not have been applicable to port services reserved exclusively for passengers, and vice versa. The implication was that, if adopted, the directive would have had an immediate effect on the provision of port services in 364 ports throughout Europe (DfT, 2005), comprehensively altering the structure of the EU port system.

Table 1: Total freight and passenger movement in ports implementing the PSD and in all EU ports (by EU member-state; in .000)

	Total freight tonnage, by				Total passenger movements, by			
Member State	No of PSD ports	(i) PSD ports	(ii) all ports	PSD as % of total	No of PSD ports[1]	(i) PSD ports	(ii) all ports	PSD as % of total
Belgium	4	178,689	181,110	99%	0	591	739	80%
Cyprus	2	4,823	7,220	67%	0	287	287	100%
Denmark	14	77,061	103,954	74%	36	47,352	48,653	97%
Estonia	4	43,467	44,682	97%	0	5,172	5,172	100%
Finland	16	90,633	104,439	87%	2	15,865	16,341	97%
France	19	308,767	319,032	97%	8	27,148	27,405	99%
Germany	16	246,349	254,834	97%	22	30,009	32,146	93%
Greece	20	132,870	-	-	0	-	-	-
Ireland	4	36,927	44,919	82%	2	3,567	3,747	95%
Italy	38	457,789	477,028	96%	27	79,831	82,576	97%
Netherlands	10	407,421	410,330	99%	0	1,981	2,015	98%
Norway	11	148,486	190,034	78%	1	4,598	4,656	99%
Poland	5	50,712	51,020	99%	0	2,886	3,188	91%
Portugal	5	53,888	57,470	94%	0	-	-	-
Slovenia	1	10,720	10,788	99%	0	-	-	-
Spain	24	321,651	326,001	99%	2	19,510	20,041	97%
Sweden	25	136,626	161,454	85%	5	32,263	32,748	99%
UK	40	526,869	555,662	95%	5	33,009	33,708	98%

Note 1: In addition to ports that already meet the freight traffic threshold.
Source: UK Department for Transport, 2005 (Annex, D).

3. Major issues of conflict

This Commission's second initiative (PSD II) created tensions between stakeholders and the EU institutions. A major issue related to the selection procedure for authorisations for service provision. Among the main questions was the maximum duration of authorisations, with port authorities demanding lengthier periods than those suggested by the Commission. This preference could be adequately explained taking into account that the ports have opted in several cases for authorisations that extend to 75 or even 99 years of duration. Port operators and port authorities argued that shorter time authorisation could not allow for the full amortization of their investments in movable assets, and especially those investments immovable assets fully amortized. Evidently, these concerns triggered the reaction of port authorities on other issues as well.

Compensations to existing service providers and the transitional regime were two further controversial issues. Details regarding compensation for past investments, especially in cases when a service provider would not yet be able to renew its authorisation, were of great importance for port operators. Yet these details were not clarified in the context of the PSD II proposal. As regards the transitional period between the adoption of the PSD and its implementation, the industry (foremost port authorities) demanded sufficient time that would facilitate the amortization of past investments.

There was also a dilemma regarding whether port authorities would continue to provide port services within the future regime, or if they should be neutral arbiters of port services provision by third parties. Whilst the Commission initially opted for the former option, port authorities opted for the latter.

The various forms of state aid provided to ports by EU member states was an additional controversial issue. This public funding has the target to restructure the port facilities and allow for adjustment to contemporary challenges. However, it is also responsible for situations that cause distortions of port competition. Market opening within a port demands clarification of the condition for capital mobilisation in order to avoid situations where this mobilisation favours certain port enterprises. As explained in the forthcoming sections, certain stakeholders were particularly interested in such clarifications.

The proposed permission of self-handling and the liberalisation of pilotage led to numerous reactions as well. On the issue of self-handling, under current national rules, port authorities in Europe are required to employ only local union labourers to load and unload cargo. However, exemptions are not rare and are (mostly) observed in dedicated terminals. Shipping companies and some ports would like casual labourers or ship crews to be allowed to perform these services. Trade unions, as well as port operators, were against the potential of self-handling services. Port authorities were divided, because in some ports self-handling is already applied. Shipowners and shippers had a united front in favour of allowing self-handling. As regards pilotage, many stakeholders advocated the degrading safety implications due to a potential liberalisation of this service. Maritime pilots felt strongly, stating that "*pilotage isn't a commercial service but a Maritime Public Safety Service with responsibility for protection of the environment*" (EMPA, 2005).

4. Policy makers' reactions

Despite the presence of all these controversies, a number of parameters contributed to the institutional 'push' toward the fast re-introduction of the PSD proposal in the European agenda. For the EU policy-making standards, the time span between the rejection of the controversial initial proposal and the re-opening of the process was extremely tight indeed.

European integration is based on the liberalisation of the economy. Both PSD proposals were consistent with this spirit. Within the European integration experiment, the port sector has been among the few cases in which the liberalisation process has not progressed. Both the industrial complexity, produced by the heterogeneity of the industry, and the difficulties in identifying port policy either as an 'industrial' or as a 'transport' policy, contributed to the observed difficulties to promote a supranational regime (Pallis, 1997).

On the other hand, in the 1990s, port market liberalisation progressed in the context of the national policies (i.e. Italy, Spain, etc). Notably, alongside PSD II, the Commission introduced a proposal for another directive (the 'Bolkenstein' Directive) aiming to eliminate any barriers that prevent businesses from offering services across the EU. This initiative re-emphasised the EU commitment to liberalise services in the Single European Market, and even though it was decided to exclude transport and thus port services from the scope of the directive (due to their peculiarity), the spirit is apparent. Moreover, the European Court of Justice had started to examine concessions to port service providers or labour organisations on a case-by-case basis.

Bureaucratic politics stand as another influential parameter. The urgent reintroduction of the PSD took place just two months before the Commission's college stepped off power, with 'self-motivation' of the departing politicians being evident. To the Commissioner of the time responsible for Transport (Loyola de Palacio), the PSD proposal was a key theme of the transport strategy that she pursued during her stay in office. In an attempt to push it through, she had already advanced the application of the rule in her country of origin, Spain (Orru, 2005). Similarly to what it has done in other relevant policy areas, like maritime safety (Pallis, 2006) and shortsea shipping (Alexopoulos, 2000), the European Commission attempted to act as policy-innovator and act as the key actor for promoting port policy. The potential of progress was limited by that fact as the content of this second proposal was considerably different from the text that the conciliation between the Commission and the European Parliament had produced in 2003. The EP, which had voted against the first proposal, was not happy with this 'premature' Commission initiative.

This institutional conflict advanced the existing participation of maritime interests in the EU port policy-making process. In general, both the EP and the Commission maintain a rather good relationship with interest groups (Mahoney, 2004), and in the case of the PSD, the EP invested further towards this direction. Consistent with the route of the enforcement of the relationship with the interest groups, the EP organised a public hearing with the participation of all interest groups (June 2005). The results of this meeting, along with a number of impact studies that were presented during the public hearing, or were publicly circulated (ESPO, 2004b; DfT, 2005; OSC, 2005), further enhanced the discontent vis-à-vis the Commission's proposal.

At the national level, governments were divided as well. Although they all agreed in principal, several tensions were apparent and portrayed as a conflict between the continental and the Anglo-Saxon approach to port organisation. In fact, some member-states that had already opened access to the port services market worried that the PSD II would have negative effects, i.e. crowding-out of existing investors, and creating a mid-term legal uncertainty. Others (i.e. the Mediterranean countries and the new members of the EU), however, were in favour of the PSD II proposal, seeking the introduction of intra-port competition in their national port systems.

5. Interest groups reactions

A number of interest groups attempted to promote a large number of amendments and lead the PSD proposal toward a more positive (in their terms) direction, or even to provoke the rejection of the proposal. They did so by following multi-level lobbying practices (Pallis, 2007), which acknowledge the dynamic of both the Commission and the EP in the EU institutional setting. Impact studies, either commissioned by stakeholders (ESPO, 2004b), national governments (DfT, 2005; ECORYS and Trandemco, 2005) or third-parties (OSC, 2005), provided an input towards the formation of the critical stance advocated by these interest-groups.

In practice, the strong stance of port stakeholders towards the PSD II led to the formation of an informal alliance and an ‘issue network’ (Greenwood, 2003). The joint position statement of ESPO and FEPORT (2002) provides an illustrative example. However, this network was formed incidentally, and corporation between the maritime interest groups remains occasional.

Port Authorities

For port authorities, reaching a common position vis-à-vis the PSD II was not an easy task, especially since the Euro-federation that represents them (ESPO - European Sea Ports Organisation) has a wider membership than the EU. Some ESPO members opposed the directive, with others being neutral. The existence of (quasi)open market access regimes in some North European ports added to the Anglo-Saxon thoughts that the directive might induce a number of disturbing structural changes. This was observed especially in those cases in which intra-port competition is already a fact. In the context of ESPO, port authorities reached a sceptical common position, and they actively promoted this stance in the EU policy-making process.

During the consultation process regarding the initial PSD proposal, ESPO was in favour of the directive. The situation changed dramatically after the hasty reintroduction of the matter in the agenda. The core of the problem was that PSD II ignored the amendments of the conciliation procedure that had taken place in the context of the discussion of the first proposal (2003). For port authorities, the details of the agreement that had been reached within that process were very important: the agreement had incorporated most of their demands.

The reaction to the PSD II proposal was mostly based on the adoption by the Commission of a ‘one size fits all’ policy approach and the consequent ‘absence of flexibility’. On these grounds, the main areas in which ESPO sought to alter the Directive proposal were:

- The protection of the interests of existing providers of port services in European ports.
- The mandatory authorisations for potential and existing providers.
- The maximum durations for authorisations.
- The provisions regarding self-handling of cargoes.
- The simplification of the proposed regime.

As regards authorisations, ESPO requested an increase in the number of criteria for the limitation of (existing or potential) service providers and demanded that the personnel should be a choice of the service provider itself. ESPO expected a clarification on the exact way that the new regime would limit the continuation of the existing providers’ operation, demanding a reconsideration of the rights of existing providers. Furthermore, it advocated that the port authority and the competent authority for granting and monitoring authorisations should be the same body. ESPO’s proposition about durations was: (a) in the case of no-investments by the providers, it recommended a 10-year limit; (b) in the case of investments in movable assets, it recommended a 15-year limit; (c) in the case of investments in immovable assets, it recommended a 45-year limit. As expected, port authorities were strongly discontented with the prospect of allowing self-handling by shipping companies.

ESPO (2005) demanded the withdrawal of the PSD II proposal (November 2005). To support this view and, not least, to enhance the quality of the internal consultation, ESPO initiated an economic impact study, which assessed the consequences that the implementation of the PSD II would have. This study produced two very interesting results. First, that 19 out of the 20 participating ports identified a negative impact by the implementation of the PSD II. Second, that the participating ports had once again demonstrated the vital heterogeneity of the port industry, either by expressing different opinions on the same issue, or by giving different answers to the same questions, (ESPO, 2004b).

Precisely because of this heterogeneity, the various impact studies that took place during the same period reached different conclusions depending on the examined sample. Some concluded that there would be no substantial impact (OSC, 2005), whilst others predicted a positive impact (Pallis and Vagellas, 2005). These differentiated results came to emphasise the importance of the sector's diversity.

Private Port Operators

Reaching a unanimous position was less complicated for private port operators. The Federation of Private Port Operators (FEPORT) opposed both Commission PSD proposals. PSD II was even more annoying than the first one; insofar as it differed in the agreement that had been reached during the conciliation procedure of the first proposal. On the practical front, FEPORT had major objections, in essence demanding a rewriting of the proposal. In addition to the self-handling provisions which were considered as the major problem, FEPORT requested changes in the provisions about mandatory authorisations, durations, compensation, and transition periods.

FEPORT's view was that the criteria for providing an authorisation should be further increased. Agreeing with ESPO, FEPORT argued that the port authority and the competent authority could be the same body, as far as an anti-trust organization would secure the fair and transparent functioning of the port. FEPORT also shared ESPO's position on the issue of service providers' limitation. As regards the "really important" duration of authorisations, FEPORT demanded an increase of the authorisations' maximum length, the preservation of the right to extend an authorisation, and the examination of each case with an agreement between the two contracted parts. As far as self-handling was concerned, FEPORT advocated the need for the same criteria as in the case of other services to be applied, and the examination of each case separately. Finally, FEPORT (2005) demanded a framework that, in case of authorisation termination, would provide compensation which would be greater than the amount of amortized investments.

The opposition of the port industry as a whole (i.e. including both port authorities and private operators) had been detailed earlier by a joint ESPO and FEPORT statement (March 2002) concerning the first PSD proposal. The core of the problem was that, according to these two interest groups representing the most significant parts of the port industry, the conciliation draft, which had not been taken into consideration by the

Commission, could be a starting point. The second proposal had the problems of the first one, while it introduced additional ones as well.

Port authorities and private operators assessed that, at this point at least, the European Parliament provided a stand to advocate their cause. Hence, during the consultation process, ESPO and FEPORT decided to publicise their positions and lobby the European Parliament with a more intense and systematic way. Due to the indications of a shift of powers between the European institutions, the strategy of these two interest groups also changed: they decided to accompany the strategy of approaching the Commission's and other institutions' officials (access strategy), with the use of strategies which had a more public appeal (voice strategy).

Shipowners

The stance of shipowners and shippers vis-à-vis the liberalisation of port services and the PSD II proposal had constantly been positive. Shipowners in particular advocated the liberalization of the port services for more than a decade, whether or not this liberalisation has been discussed in the context of other maritime policy initiatives (i.e. the promotion of shortsea shipping in Europe) or the port policy *per se*. ECSA (European Community Shipowners Association) reassured this positive stance even after the rejection of the PSD II proposal by the European Parliament. In reaction to this rejection, French shipowners stated their will for a restart of the process of port services liberalization as soon as possible.[1]

Shipowners expressed their own position in almost all the controversial fields of the proposal. According to them, authorisations should be of optional character and each service provider should be scrutinized for professional efficiency. On the issue of limitations to services' provision, ECSA was not very positive. Shipowners argued for an exclusion of these provisions from the EU policy framework, as well as for the need to further clarify the proposed criteria and the 'reasons of national security' that could lead to such limitations. Finally, ECSA advocated that there should be at least two service providers for each port service. As far as authorisations were concerned, ECSA demanded the reduction of their duration and the extension of the authorisation only in the cases in which important investments occurred. On the issue of self-handling, ECSA endorsed a positive stance but wanted the implementation of self-handling to be limited to ocean shipping personnel, rather than expanded to land-based personnel. Within its statement during the PSD II related public hearing organised by the European Parliament, ECSA (2005) stated that: "*Whilst insisting on a further liberalization, ECSA feels that the proposed Directive II, needs further study and analysis particularly on five critical points notably: authorisation, duration, compensation, transitional periods and self-handling*".

Shipowners are among the most powerful stakeholders, and they demonstrated the ability to influence EU maritime transport policy developments and direct them towards their interests (Pallis, 2002). Their relative power is the outcome of their economic power and, foremost, of the advantage offered by capital mobility (Aspinwall, 1995), which allows them to pressure political institutions successfully at national and regional supranational levels. As a powerful maritime interest group, ECSA had used different

[1] See the reaction published only five days after the rejection of the Commission proposal: French owners: EU port talks must restart. *Lloyd's List,* 23 January 2006.

strategies, taking advantage of its economical and political power. Like port industry representatives, in the case of the PSD II proposal, ECSA expressed its preferences publicly, via statements that aimed at influencing all the EU institutions, including the EP. Yet, the economic conditions and the consequential port industries' stance prevailed over the shipowners' capacity to determine policy outputs.

Shippers

Shippers, like other interest groups of the maritime sector, participated in the EP public hearing of June 2005, demonstrating a change in their interests' representation strategy. They chose a 'voice' strategy with a more public appeal, instead of an 'access strategy' (Beyers, 2004).

The European Shippers Council (ESC) expressed similar positions to the shipowners, while, in some respects (i.e. ports in which the directive would apply), it advocated a more liberalised regime. ESC welcomed the PSD II proposal and pushed for further services liberalisation. Their stance was in favour of the further extension of the scope of the PSD, in a way that it would cover *all* EU ports and *all* port services, rather than those defined in the proposal. Advocating that shippers are often victims of protectionism of the liner shipping industry, they lobbied for the 'full liberalisation' of port services. Among others, the latter was the opportunity to liberalise a part of the transport chain, with other parts expected to follow. As regards the PSD II proposal, the shippers' major concerns related to two issues: the durations of authorisations and self-handling, respectively. On the issue of self-handling, shippers were positive, whilst they demanded a specific period determination of concessions' durations by the regulatory regime. As regards self-handling, they pursued a liberalised regime that would not create an exclusive right of services provision by the carriers of the cargoes (shipowners) but would create opportunities for them to handle these cargoes.

Trade Unions

Dockworkers were the most discontent stakeholders. Their stance had been expressed in the context of the discussions of the first PSD proposal, with their strong opposition contributing to the failure of the proposal. This happened despite the fact that in this process transport workers were not exactly united. Different organizations, including the European branch of ITF (International Transport Workers Federation), the ETF (European Transport Workers Federation) and the IDC (International Dockworkers Council), followed separate campaigns. There were sporadic national level campaigns (i.e. the Netherlands), as well. Progressively, trade unions realised that a united front would contribute to the accomplishment of their goals and provoke the greatest pressure possible.

In order for this collective action to result in effective union articulation, new labour networks were established aiming at a trans-national corporation (Turnbull, 2005) that would take advantage of two industrial characteristics: firstly, the immobility of capital and secondly a strong workplace union organization. The trade unions had a 'weak start' during the first PSD proposal, but during the discussions of the PSD II proposal they were more organised and expressed their resistance dynamically.

Three were the topics that concerned port workers mostly: (a) the mandatory character of authorisations, (b) the prospect of self-handling, and (c) the definition of the competent authority. Port workers advocated that authorisations should be optional, rather than mandatory, and that further criteria for potential service providers should be introduced. They also argued that in all cases the port authority should differ from the competent authority. This should be ensured by the existence of an anti-trust organisation. As expected, trade unions were in principal against any form of self-handling, arguing that self-handling was against Decision 137 of the International Labour Organisation (ILO), on safety and social grounds.

Maintaining a dynamic momentum, dockworkers continued to declare their opposition to the liberalisation of port services. Unlike other maritime interest groups, trade unions like any social character interest groups followed a voice strategy throughout the policy-making process. With their statements and especially their dynamic demonstrations, they pressed to influence public opinion, as well as the vote of the members of the European Parliament. Their campaign was marked by the dynamic demonstrations of January 2006, when dockworkers marched (and had a violent confrontation with police forces) in Strasbourg. These events took place in proximity to the European Parliament's buildings. As they were 'heard and felt' by the MEPs, it can be argued that these events contributed in favour of the dockworkers' stance during the voting that took place some days later: the vote resulted in the rejection of the PSD II proposal by an overwhelming majority.

Other Interest Groups

The other interest groups that expressed their point of view during the policymaking process were the Euro-groups representing freight forwarders (CLECAT), the European Tug-Owners Association (ETA), the European Maritime Pilots Association (EMPA) and the European Boatmen Association (EBA). Each of these associations had different priorities and focused on different aspects of the proposed port policy.

Overall, CLECAT identified a very positive development for the European port industry in the proposal. However, it put forward some amendments, in particular the provisions concerning granting of authorisations and self-handling. In the latter case CLECAT was in support of allowing self-handling in European ports. The EBA statement was also positive, as it stated that the main disagreement was not the principle but the details of the proposed PSD II: their demand was the exclusion of self-handling from the span of the directive.

EMPA's main concern was the potential inclusion of pilotage services within the span of the PSD. Strongly arguing that pilotage as a service has a lot to do with matters of safety and cannot be treated as a profitable occupation, EMPA made clear that pilots in the EU would not tolerate the pilotage inclusion in the PSD. Finally, the ETA stated very clearly that it did not support the drafted directive. This stance was based on the fact that the revised proposal ignored the details of the agreement that had been reached in the conciliation committee. That said, ETA did not clarify if it condemned the whole effort in principle or because of some specific details. It might be assumed that for ETA the main problem was that it wanted different criteria for the service of towage.

Consumers

As they are not organised in an interest-group, the ultimate consumers' perspective was not expressed in a systematic way during the discussion of any of the two PSD policy proposals. The debate was dominated by other interest groups and the outcome was determined by the power of interested parties on the supply side and their success in preserving their own powerful positions.

Notably, these consumers would be among the beneficiaries of the proposed increased competition in the European port sector. The main effects of the endorsement of the proposed regime would be the lowering of entry barriers for entering the market and the enhancement of the intra-port competition. Today, regulatory (as well as economic, and geographical) entry barriers are substantial in most seaports and are getting more complex as modern ports are increasingly embedded in supply chains and parts of multilayered networks with multiple entry-levels. Lowering entry barriers is desirable from an economic point of view, since they enhance the contestability of markets and increase the level of intra-port competition (De Langen and Pallis, 2006b). The latter might result in substantial benefits, such as preventing abuse of market power and fostering specialisation. Users of services, especially the captive ones, are less exposed to monopolistic pricing conditions and excess rent seeking from service providers, a positive effect that results in lower final prices that the consumer ultimate pays. Furthermore, in conditions of intra-port competition, port service providers have incentives to specialise and differentiate their services from competitors in the same port. This results in faster implementation of new technologies and business models, in turn leading to more tailor-made services. The ultimate effects are the efficient and effective transportation of every type of cargo to be consumed (De Langen and Pallis, 2006a).

6. Conclusions

A core element in the search of a long-term EU port policy has been the opening of access in the provision of port services in European ports. Free market operation is in line with the wider project of European political and economic integration, a fact that was recently highlighted by the Bolkenstein directive aiming at liberalising services in the EU. However, due to the peculiarities of the market, port services were excluded from this directive and have been the subject of a different Commission's proposal on a port services directive (PSD). This measure would restructure the industry, thus the proposal became part of a lengthy debate. As the PSD has been rejected twice by the EP, the debate has (at least temporarily) closed with a policy output failure.

The analysis demonstrated that interest groups formed an informal 'issue network', aiming at influencing the policy-making process. Although they do not share the same perspectives, vested interests lobbied for the same goal: to achieve the withdrawal of the PSD II proposal, due to the identification of structural deficiencies in the proposed regime (Table 2).

In the aftermath of the introduction of the PSD II proposal, maritime interest groups identified institutional tensions. They realised the unease of the European Parliament and used voice strategies towards this institution in order to influence the final policy outcome successfully. Assisted by the core characteristics of the economic environment (mostly by the heterogeneity of the European port sector and the difficulties that this heterogeneity causes any attempt to adopt any 'one size fits all' supranational port policy), the stance of organised maritime interests decisively contributed to the second rejection of this EU port policy initiative.

By seeking a strict pan-European regime with minimum implementation flexibility, the Commission was unable to address the concerns of stakeholders. Furthermore, the Commission overlooked the draft of the Conciliation Committee that had been agreed in 2003, even though this agreement was considered as a good starting point for further discussions by several interest groups. On the contrary, the Commission preferred to draw up a new proposal virtually from scratch. In certain aspects, this second proposal was stricter (i.e. durations of authorisations) and thus less attractive to maritime interests than the conciliation committee draft, or even the initial PSD proposal. Moreover, this Commission's stance created certain institutional tensions. This situation gave the opportunity to several organised interests to advocate the maximum of their preferences, and seek the accommodation of all of their demands rather than search for a workable policy regime.

Table 2: Maritime interest groups vs. the PSD II proposal

	ESPO	FEPORT	ECSA	ESC	ETF	EMPA	CLECAT	ETA	EBA
Mandatory nature of authorizations for port services provision	-	-	+	+ +	+	n.e	-	--	n.e
Selection procedure	-	-	+	-	n.a.	n.e	n.e	n.e.	n.e
Limitation of service providers	+	-	CC	-	n.a.	n.e.	n.e	n.e.	n.e
Mandatory nature of authorizations for port services provision	-	-	+	+ +	+	n.e	-	--	n.e
Compensation of existing providers	-	- -	CC	-	n.e	n.e	+	-	n.e
Transitional periods	-	- -	CC	-	-	n.e	-	--	n.e
Liberalisation of Self-handling	- -	- -	+	+	- -	- -	+ +	n.e.	- -
Liberalisation of Pilotage services	- -	n.e.	+ +	+	+	- -	n.e.	n.e.	- -
Competent Authority	-	-	n.e.	n.e.	+	n.e.	n.e.	n.e.	n.e.

+ +: strongly positive.
+: positive, but amendments.
- : negative.
- -: strongly negative.
CC: support of the Conciliation Committee text.
n.e.: No opinion Expressed.
n.a.: non available.

In terms of content, the Commission could have worked towards the creation of a more homogenised port operating framework, before proposing such a strict regime that the PSD II aimed to introduce. For instance, there is considerable scope for initiating a European policy proposal that would create the essential background conditions, like the clear and similar public funding regimes of port infrastructure projects, and legal certainty regarding the application of existing competition rules. Even then however, the best policy option might remain to move away from a strict regulatory approach and look for alternative solutions such as a code of good practice or interpretative guidelines on the application of the rules of the Treaty. In any case, the ultimate goal needs to remain the same: to ensure a level playing field and lower entry barriers enhancing intra-port competition and benefiting consumers.

References

Alexopoulos, N. (2000). The European Commission as policy innovator: Bureaucratic politics in perspective, PhD thesis, European University Institute, Florence.

Aspinwall, M. (1995). "Moveable Feast: Pressure Group Conflict and the European Community Shipping Policy". Ashgate, Aldershot.

Baird, A. (1982). "Transport decision makers speak: The seaport development in the European Communities Research Project", Maritime Policy and Management 9(2): 83-102.

Beyers, J. (2004). "Voice and Access: Political Practices of European Interest Associations", European Union Politics 5 (2): 211-240

CEU (Commission of the EU), (2001). "Reinforcing quality services in Sea Ports: A Key for European transport". Com (2001) 35, final, Commission of the EU, Brussels.

CEU, (2004). "Proposal for a Directive on market access to port services", Com (2004)654, final, Commission of the EU, Brussels.

Chlomoudis, C.I. and Pallis, A.A. (2002). European Port Policy: Towards a Long-term Strategy, Edward Elgar, Cheltenham.

De Langen, P.W. and Pallis, A.A. (2006a). "The effects of intra-port competition", International Journal of Transport Economics XXXIII(1): 69-85;

De Langen, P.W. and Pallis, A.A. (2006b). "Entry Barriers in Seaports", Proceedings of the International Association of Maritime Economists Conference, Melbourne, Australia

DfT (Department for Transport, UK), (2005). Initial regulatory impact assessment: Market Access to Port Services Directive, London: DfT 2005.

ECORYS and Trademco (2005). Complementary Economic Evaluation study on the Commission proposal for a Directive on market access to port services. Final Report for the European Commission - DG TREN. Rotterdam and Athens: ECORYS and Trademco.

ECSA, (2005). Position paper presented at the public hearing of the European Parliament and the European Commission . Brussels: ECSA.

EMPA, (2005). "Position on Market Access to Port Services", 25 February 2005.

ESPO, (2004a). News Plus, Volume 10.25, 30 September 2004.

ESPO, (2004b). Impact assessment of the Proposal for a Directive of the European Parliament and of the Council on Market Access to Port Services. Mimeo.

ESPO (2005). News Plus, Volume 11.18, 22 November 2005.

ESPO and FEPORT (2002). Joint Statement on the European Commission's Amended Proposal for a Directive on Market Access to Port Services, 15 March 2002, Brussels.

FEPORT (2005). Position paper presented at the public hearing of the European Parliament and the European Commission. Brussels: FEPORT.

Goss, R. (2006). "Competition is key to wellbeing of ports", Lloyd's List, 27 November 2006.

Greenwood, J. (2003). Interest Representation in the European Union. Basingstoke: Palgrave.

Mahoney C. (2004). "The Power of Institutions, State and Interest Group Activity in the European Union", European Union Politics 5(4): 441-466.

Orru, E. (2005). Current Organization of Port Services in Europe. International Workshop on the 2nd EU Port Package: The good or the last try? University of Antwerp 2005

OSC (Ocean Shipping Consultants), (2005). The proposed Directive on Market Access to Port Services and Container Terminal Operations in Northern Europe: A critical Review, OSC, Surrey.

Pallis, A.A. (1997). "Towards a Common Ports Policy? EU-Proposals and the Industry's Perceptions", Maritime Policy and Management 24(4): 365-380.

Pallis, A.A. (2002). The Common EU Maritime Transport Policy. Ashgate, Aldershot.

Pallis, A.A. (2006). 'Institutional dynamism in the EU policy-making: The evolution of the EU maritime safety policy", Journal of European Integration 28 (2): 137-157

Pallis, A.A. (2007). "Maritime Interests in the EU Policy-making: Structures, Practicea and Governability of Collective action", WMU Journal of Maritime Affairs, 6(1): 3-20.

Pallis, A.A. and Vaggelas, G.K. (2005). "Port Competitiveness and the EU 'Port services' Directive: The Case of Greek Ports", Maritime Economics and Logistics 7(2): 116-140.

Psaraftis, H.N. (2005). "EU ports policy: Where do we go from here?" Maritime Economics and Logistics 7(1):73-82.

Turnbull, P. (2005). "The War on Europe's Waterfront – Repertoires of Power in the Port Transport Industry", British Journal of Industrial Relations 44(2): 305-326.

European Transport \ Trasporti Europei n.38 (2008): 32-46

New challenges and the future of Italian superyacht yards

Dionisia Cazzaniga Francesetti [1*]

[1] *Computer Science, Largo Pontecorvo, University of Pisa, Italy*

Abstract

This work aims to acquire greater knowledge on the structure of heterogeneous oligopoly in the superyacht production industry, and to investigate how the fierce competition mounted by newcomers who seek to beat down the price of superyachts can lead to problems for the large European, American and above all Italian yards as well as small accessories manufacturers. As a reference point of this study attention will focus on the Viareggio cluster whose companies are recognized as ranking first in all the international classifications. If stiffer competition or a decline in demand or, above all, sharply predatory prices set by the newcomers, were to create severely adverse conditions, the large companies in EU and USA and particularly in Italy mounting their counter-attack.

Keywords: Shipyards; Superyacht; New comers; SMEs; Italian superyachts; Competition.

1. Introduction

This work aims: to acquire greater knowledge on the structure of heterogeneous oligopoly in the superyacht production industry and to investigate how the fierce competition mounted by newcomers who seek to beat down the price of superyachts can lead to problems for the large European, American and above all Italian yards as well as small accessories manufacturers. As a reference point of this study attention will focus above all on the well known Viareggio cluster.

In the first section in depth the main countries, the most important shipyards, the structure, performance and conduct of the superyacht industry are examined.

In the second section the fierce battle to capture a share in the megayacht production market is underlined. Financially aggressive new entrants such as Taiwan or Hong Kong, China, or Dubai and others, have now entered the battle.

All these new comers are low labor costs countries and all the shipbuilding countries are endeavoring to ensure that their yards capture not only the markets of the rich

* Corresponding author: Dionisia Cazzaniga Francesetti (dcf@di.unipi.it)

Western countries but also at least a part of the Middle Eastern markets and the emergent markets of Russia, India and the Far East as well as demand from the charter companies.

In conclusion we suggest that if stiffer competition or a decline in demand or, above all, sharply predatory prices set by the newcomers, were to create severely adverse conditions, the large companies in EU and USA and particularly in Italy declare that they are already reducing costs with various different methods. Among the latter, the following are of considerable importance: an already highly accentuated process of consolidation and diversification in the field of superyacht services, marinas, hotels is being further speeded up; production systems similar to those characterizing the automobile sector are increasingly adopted; a further process of selection of suppliers/outsourced enterprises is being undertaken, retaining close cooperative links only with the best suppliers and moving towards a more vertically integrated organization; the shift towards buying all or part of the accessories from the more esteemed SMEs that are developing in the newcomer countries, and/or towards expanding relations with international suppliers, is already well under way; finally, delocalizing all or part of production in emerging countries has already begun.

We specify that even if the issue is of a great interest, unfortunately the scientific literature doesn't treat it; only statistical data are available.

2. The superyacht industry

2.1 A special industry

Analysis of the structure of superyacht shipyards requires a number of complex considerations. *Firstly*, it is important to note that superyachts represent a very special type of production, they are situated in the top range of the pyramid of luxury (Icomia 2005) and currently account for about 40% in value of the world nautical market. Luxury yachts are extremely costly products in the supreme luxury range.

These "super-yachts" cannot fail to be privy to a very wealthy clientele that, in the glossary of high finance is defined as "ultra high net worth individuals". This elite category includes those individuals with financial assets of over thirty million dollars. In 2002 the number of "ultra high net worth individuals" present around the world amounted to about 60,000, of which more than half evenly distributed between the USA and Europe.

The fact that from 1996 to 2002 the number of "ultra high net worth individuals" rose by 60% shows how even a negative macro-economic result has a lesser impact on this clientele compared to the average one of the sector. The ultra-high net worth individuals (UHNWIs) is comprised of people with financial assets in excess of US$37.2 trillion. In the global population, they represent approximately 1% of the total high net worth population (Source: Merrill Lynch, http://www.capgemini.com; Global Private Banking/Wealth Management Survey 2006, PricewaterhouseCoopers). Three years ago, *Forbes* magazine listed 476 billionaires on its list of the world's richest people. The magazine's most recent list, released in March 2006, shows the number of billionaires around the globe has climbed to 793. This cannot fail to be reflected also in the demand for super-yachts, these too marginally affected by the general economic trend, for these boats, in fact, literature speaks of anti-cyclical demand. Thus the demand of superyachts keep on with factors such as perception of one's personality, exclusiveness and uniqueness in the sense that it is impossible even for the rich to own a similar product of niche.

Secondly, it should also be noted that the growth of world GNP has influenced demand for these special luxury goods (normal luxury goods are typically dependent on the economic cycle). The great increase in world GNP after 2002 has led to a rise in the number of the super rich in some countries (in 2003 GNP rose by 4.0%, in 2004 by 5.1%, in 2005 by 4.3%, in 2006 by 4.3%, Source IMF).

The growth of the economic worldwide cycle affects the demand for superyachts in the sense that the rich who are not sufficiently affluent to be able to purchase and maintain superyachts may opt instead to hire them. Thus superyacht hiring is a financially profitable investment for the chartering companies engaged in this rental sector. In addition to purchasing for hiring, as is typical of chartering companies but also banks and financial institutions (which frequently use yachts as venues for corporate hospitality events with their best customers), other forms of purchasing can also be found, such as shared ownership.

2.2 Superyachts: countries and shipyards.

The Global Order Book 2006 of Showboat International reports that 688 projects (81,852 feet of yachts) are currently contracted or under construction. Italy retained its position as the world's leading luxury yacht-building nation, with 260 units (29,804 linear feet of boats). The United States ranked second in that category, with 85 units (10,621 linear feet). The Netherlands and the United Kingdom retained third and fourth place, respectively, while Germany surged to fifth place.

Table 1: Top 10 countries in 2006.

Country	*Total length in meters*	*Average length in meters*	*N° of project*	*Rank 2005*
1 - Italy	9084,26	35,05	260	1
2 - USA	3237,28	38,10	85	2
3 - Holland	2430,17	46,63	52	3
4 - UK	1602,94	29,26	55	4
5 - Germany	1414,58	74,37	19	6
6 - China	1092,10	30,48	36	8
7 - Taiwan	1045,46	28,35	37	5
8 - Denmark	907,08	31,39	29	9
9 - NewZealand	740,97	46,33	16	7
10 - France	462,08	38,40	12	10

Source: ICOMIA.

On the strength of its total construction, Azimut-Benetti (I) retained its position as the world's leading builder, while the Ferretti Group (I) held its position in second place. Sunseeker (UK) advanced to third place, supplanting Rodriguez Group, which fell to fourth (Rodriguez produces only semicustom superyachts). Royal Denship (NL), which ranked ninth last year, jumped to fifth place. We point out that Germany and the Netherlands in the custom motor superyacht business produce superyachts with a length longer than all other countries in EU.

Table 2: Top 20 Shipyards in 2006.

Shipyard	*Total length in meters*	*Average length in meters*	*Number of projects*	*Rank 2005*
1 - AzimutBenetti	2575,56	37,19	69	1
2 - Ferretti Group	2555,77	32	77	2
3 - Sunseeker	1329,84	27,13	49	4
4 - RodriguezGroup	1035,71	28,65	36	3
5 - RoyalDenship	907,08	31,39	29	9
6 - Fipa Group	718,72	34,14	21	-
7 - Feadship	642,21	58,22	11	6
8 - Lurssen	631,55	70,1	9	5
9 - Horizon	604,42	27,43	22	11
10 - Trinity	579,42	48,16	12	8
11 - Westport	571,2	38,1	15	7
12 - Heesen	500,48	41,76	12	19
13 - Sensation	464,82	51,51	9	13
14 - PeriniNavi	446,23	55,78	8	15
15 - Hatteras	402,34	24,99	16	12
16 - Kha Shing	331,93	30,18	11	10
17 - Cheoy Lee	317,6	28,96	11	-
18 - Burger	297,79	42,37	7	80
19 - Amels	295,35	59,13	5	14
20 - Christensen	283,77	47,24	6	17

Source: Showboat International 2006.

It is worth noting that Italian shipbuilding industry is in continual growth: over the last years (2003-2005) it has gone from 33.5% to 38.2% of the total output, almost 5 percent in only 3 years.

But since 2004 also the growth of shipyards of the so-called emerging countries with lower labor costs has been considerable: in 2006 the ten yards of Taiwan that are active in the sector of superyacht production, in which they have been present for quite some time, have orders for 37 yachts. We underline that Taiwan is also planning a 46.5 hectare yacht manufacturing center for small accessories or third party manufacturers, which are expected to provide support above all for superyacht construction.

Four Chinese yards (Cheoy Lee, CMI, Kingship, Marlow Marine), despite having only recently entered this particular sector, already boast 36 orders.

In Moscow, where there are three yards (MCC3, Hotchya, Nakhimov), there is undeniably a development of superyacht construction specifically oriented towards large constructions made of steel based on know-how acquired in the building of metal ships, above all military vessels.

In Poland a number of yards, among which Royalship plays a prominent role, have been converted for use in the construction of large recreational boats. Brazil registered one yacht on the order book in 2001, this year's list shows three yards building 11 yachts. Also worth mentioning are the large united shipyards of Dubai in the UAE, the seven Turkish yards, one in Argentine Philippines, those in Croatia etc. Source: Global Build Report, 2005-6, Luxmedia Group.

Competition is becoming fiercer and even though the engines, the steel, various parts, famous naval architects or special skills have to be bought in on the international market at the same price for all purchases, the low labor costs enable the new yards to achieve considerable savings.

2.3 Structure of the market

On the worldwide level, the structure of megayacht construction yards is that of heterogeneous oligopoly.

In heterogeneous oligopoly a small number of large yards dominate the market. Each country has just a very few large yards, a number of medium-sized yards and a plethora of small yards which may engage in independent production activity or work as third parties, or may undertake refitting, or possibly only wintering, or in some cases a mix of all these activities. The small yards may produce one or two superyachts roughly ever two years (which represents the average length of time required for completion of a yacht). All the large and medium yards with their wide range of small suppliers (accessories manufacturers) assemble the products in the yard that bestows its own brand on the superyacht. (D. Cazzaniga Francesetti 2005).

The presence of strong demand enduring over time, as has been the case during approximately the last ten years, together with a context of recognized tradition and capacity, may also lead to new entrants. Thus in countries with a well-known tradition in this type of construction (USA and Europe) small/medium-sized yards may enter the market. (On account of world mean yard size, these yards are considered small in the main producing countries, but the number of employees are above the world average in the USA. The world average stands at roughly 20 employees, Source Icomia.) However, this should not be confused with the case of new entrants in low labor cost countries, where new entrants on this growing market represent often a speculative investment.

The Viareggio cluster, whose ramifications extend throughout Tuscany, will be taken as the reference point of this study, on the basis of its world-wide fame. Data from 2005 show that Tuscany has one of three major internationally esteemed Italian yards, Benetti (Azimut-Benetti) located in Viareggio, the second is Ferretti located in Forlì, and at a distance the third: the Rodriguez group.

The cluster in Tuscany features roughly 229 small/medium-sized yard companies involved in recreational boating, 26% of these being located in Viareggio. In addition, the Tuscan cluster includes roughly 450 small accessories manufacturers (producers of goods and services). These are mainly located in Viareggio and the surrounding Lucca area (27%), 11% in Massa Carrara and a similar percentage (11%) in Pisa.

Some of the medium-sized yards located in Viareggio, known on a world level, likewise produce superyachts with the typical assembly procedure used throughout the world in both large and small/medium shipyards. It is worth mentioning medium-sized yards such as: Codecasa, CBI Navi Viareggio, Overmarine 1 and 2, Polo Nautico, Versilcraft, Italyachts, Tecnomar, Antago, Falcon (owned by Spreafico), Cantieri Riva (owned by Ferretti). In the surroundings of Viareggio one also finds medium-sized yards, same owned by the major Italian protagonists, who draw advantage from the closeness to Viareggio, such as Cantieri Arno (Rodriguez), Cantieri di Pisa (Camuzzi), Cantieri Rossi, Fita Maiora. Both the large and medium sized yards make use of the SMEs of the Tuscan districts (for example the furniture-making district) and of the enterprises belonging to the cluster.

It may seem surprising that quite a number of yards which are far from large have orders for yachts over 24 meters. But this is precisely due to the fact that the demand is growing and that Viareggio has achieved solid international renown as a producer of large recreational craft.

Alongside the yards, in Viareggio highly skilled workmanship are assured at very high level by the galaxy of accessories manufacturers of the local system, the districts and the third parties that surround the megayacht construction yards. Fine craftsmanship is not only an intrinsic feature of the central assembly yard. It is worth to emphasized that accessories manufacturers do not serve merely the national and international shipyards, but also pleasure harbors and private or chartered boats or other customers who constitute important market segments.

In effect, Viareggio has become a ‘brand’, and producing in Viareggio is now a guarantee.

2.4 Performance and conduct

Superyachts are either totally custom-made or are ‘semicustomized’ products but it is always problematic to distinguish between custom and semi-custom yachts. It is important to note that in the superyacht construction sector the large yachts, have a partially industrial character. The ‘industrial’ aspect refers to the materials used for megayacht construction. The use of steel or fiberglass implies an industrial type of production as compared to the earlier wood treatment processes performed by shipwrights.

Semicustomized yacht production allows preparation and delivery times to be speeded up, with the benefit that the challenge of competition can be faced more successfully and marketing activities aimed at satisfying the demands of impatient customers are facilitated. The larger yards have a substantial share of profits from these preconstructed vessels. Profits are higher as customers’ requirements can be met promptly. As is frequently the case for successful yacht designs, a small series of identical hulls is produced, each of which will then be personalized according to the customer’s desires and under the customer’s supervision. The demand for semicustomized yachts is increasing, as the range of customers now includes not only individual purchasers but also the chartering companies (which also purchase a substantial quantity of second-hand yachts).

At the same time, a new philosophy highlights the production not only of semicustom yachts but also of totally custom-made superyachts. For the industry this means increasing investment in Research and Development and involving all SME suppliers of the main components in a model of a ‘shared platform’.

The 'platform' approach to product development means accelerating time to market and getting it right the first time. 'Platform' is a team of professionals who work together on the design of a new boat from the start under the guidance of the large yard. With this approach, the supplier can pre-assemble the parts *as in the car industry*, but this implies that suppliers must learn know-how in a drive to improve performance by the combined use of R&D, computer-aided design and expertise. Clearly, however, in this perspective the dependence of SMEs on the larger company is intensified.

The LVMH Group and Azimut group are implementing this model. Owing to the high labour and wage costs as well as high technological capabilities that characterize the European (and, within Europe, the Italian) production landscape, these companies in the boat-building sector here, like their counterparts in other manufacturing segments, are increasingly orienting themselves towards technology-based mass production methods.

The costs and the prices of superyachts cannot be defined univocally for all yards and all yachts as they depend on volatile elements such as the fame of the yard and the designer, quality and innovative character of the fittings that are typical of the particular yard in question, perception of the luxury of the interior fittings, the latter being the most costly aspect: according to P. Miller of IUMI (2002 data), 30% of the costs are attributable to 'interior design and fittings', plus 3% of 'extras' and 'special equipment'. An increase of just a few meters in the length of the yacht may double the overall price.

Megayachts are often a *brand* of a large nautical company, or sometimes of a large conglomerate , due to the considerable financial backing required.

2.5 Concentration

The first thing to underline is the considerable concentration of the market: in fact the first 4 countries (Italy, the United States, the Netherlands, the UK) represent overall the biggest share (over 60%) .

Yet the overall degree of concentration in the main superyacht producing countries decreased from 2003 to 2004 as compared to 2004-2005.

For the 2004-2005 shipbuilding year all the main industries/countries show a diminishing market share, with the exception of Italy and the United Kingdom which shows a trend inversion.

Tabel 3: Number of orders: Italy, USA, Holland, UK, New Zealand, World.

	Italy	USA	Holland	UK	*NewZealand*	***WORLD***
2000	100	78	50	8	17	**317**
2001	140	86	53	17	15	**428**
2002	170	99	61	18	22	**505**
2003	178	82	65	34	22	**481**
2004	189	76	49	33	22	**507**
2005	249	97	48	58	22	**651**
2006	260	85	52	55	16	**688**

Source: UCINA, ICOMIA, 2006.

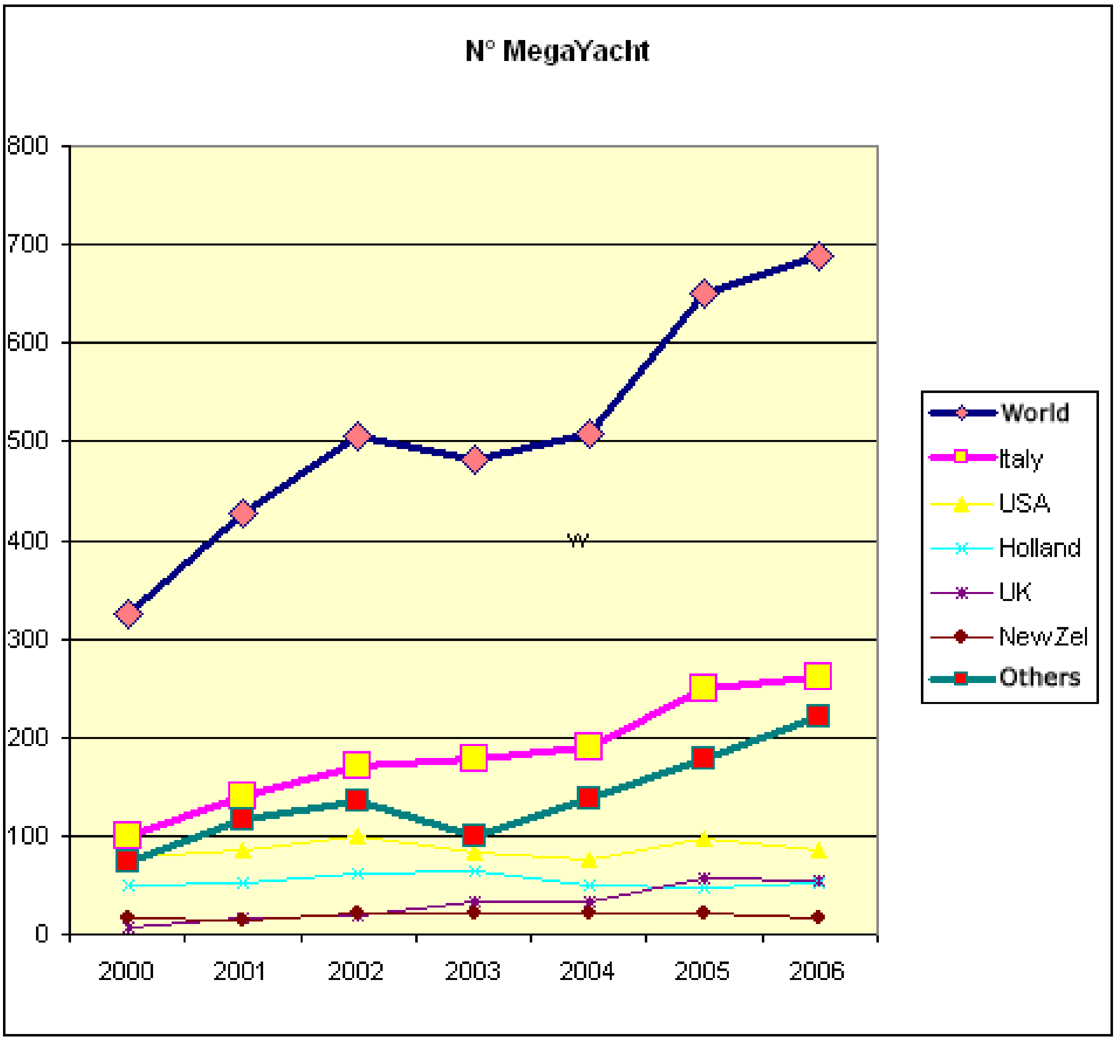

Figure 1: Orders: Italy, USA, Holland, UK, New Zealand, World.

Demand's growth push Europe's boat-building industry into a transformation to even stronger industrial manufacturing and a stronger consolidation of companies.

The top ten companies generate more than one quarter of Europe's total market volume. The top three companies in Europe and in the world (2006) Azimut-Benetti, Ferretti, Sunseeker, account for more than 10% of total market sales.

We show two examples.

The Azimut-Benetti group consolidated and systematically diversified its position: in 2000 it acquired the Lusben area in Viareggio and set up a boat repair and maintenance service center, with a roughly 40 berth private marina. During 2001 the group took over the Gobbi-Sariano yard of Piacenza and the yard of Fano in the Marche region, and in 2003 the Orlando yard in Livorno. It also entered into commercial agreements with Fraser Yachts World-wide and with Fincantieri for the design, building and marketing of steel megayachts over 70 meters long. The group can offer a service covering the complete cycle, from construction and management to the hiring of exclusive yachts for a select clientele. In addition, it organizes marinas and has interests in the hotel sector.

Ferretti is second of the world's leading manufacturers of high performance luxury motor yachts (2006). The group has grown the business significantly both organically and via complementary acquisitions. In 1998, Ferretti acquired Bertram Yachts and

Pershing, CRN in 1999, Riva in 2000, Apreamare and Mochi Craft in 2001, and Itama in 2004. Now the business operates through nine leading brands: Ferretti, Pershing, Itama, Riva, Apreamare, CRN, Custom Line, Mochi Craft and Bertram, all focused on the top end of each market segment. Permira acquired the Group in 1998, brought the Company public in 2000 and took it private again in 2002.

On 2006-11-07 Candover and Permira, announce the acquisition by Candover of a majority stake in Ferretti SpA ("Ferretti") from Permira. Majority equity funding is being provided by the Candover 2005 Fund (approximately 60%) with Permira Funds, Norberto Ferretti, Chairman, and his management team re-investing the remaining 40%. The acquisition is conditional upon EU antitrust approvals.

But this strong concentration-consolidation to favor economies of scale and to improve the market control must take into account new phenomena.

3. New comers and competition

The annual growth rate of the global recreational superyacht market was over 20% from 1998 to 2006. It is clearly a highly attractive market.

It is not only Italy, the USA, New Zealand, Holland, UK, Germany and other traditional production countries that are engaged in a fierce battle to capture a share in the megayacht production market. Other (above mentioned) financially aggressive new entrants such as Taiwan or Hong Kong, which has construction yards in China, or the United Arab Emirates with shipyards in Dubai and others, have now entered the battle.

All these new comers are low labor costs countries and all the shipbuilding countries are endeavoring to ensure that their yards capture not only the markets of the rich Western countries but also at least a part of the Middle Eastern markets and the emergent markets of Russia, India and the Far East.

The most interesting feature is that all the new entrants seek to avail themselves of highly skilled operatives and top ranking naval architects: in other words they "buy" in the USA and Europe not only the design engineers but also the outsourced/accessories manufacturing firms and the best workers and fitters for the period of the fitting out the boat. Thus local craftsmen learn by the Western know how.

The new entrants once again demonstrate the extremely competitive and globalized nature of the sector.

Within this far-reaching international panorama, China is beginning to occupy a special position (D. Cazzaniga Francesetti, 2006). For instance in July 2004 Kingship, financed by capital from Hong Kong, opened a shipyard at Zhongshan on the estuary of the Pearl River in Guangdong, only 40 km from Canton. A number of other superyacht producers are also present in China, such as Cheoy Lee Shipyards of Hong Kong, the foreign companies Marlow Marine and CMI Custom Marine International, financed by American capital.

Yet according to reliable forecasts there will be no domestic market in China for another 10 years or so. Thus, taking a quick look at an example, Kingship is already producing luxury yachts for foreign customers. The yard carries out on-boat assembly of international products deriving above all from Dutch and American accessories manufacturers who do not yet find it advantageous to delocalize but who send their own experts for the assembly phase. Kingship also assembles Chinese products, which increasingly are high-quality products as shown by their success at international trade fairs such as Mets at Amsterdam.

Thus even the Chinese yards are adopting the production model whereby it is the large yard that assembles the parts manufactured by other smaller enterprises, including the local SMEs.

The aim of Kingship, with the two superyachts that the yard has already produced and a similar number in progress, is to build up a strong position on the domestic and international market. Like other shipyards in China, Kingship is adopting a strategy that seeks to train and take on the greatest possible number of employees. At present they have 200 employees but they aim to reach 500, in order to have the capacity to assemble up to 7 yachts at a time.

All the newcomers set their prices much lower than Italian levels or those of other European countries, and likewise lower than American levels, despite the fact that they have to accept the international prices of many of the parts to be assembled. But the core of their challenge is always based on price.

Despite the fact that their purchasers are immensely wealthy, the markdowns are such (even up to 30%) that the substantial reductions prove highly attractive. In particular these superyachts are attractive if the boat is destined to be used by chartering companies.

The growth, but also the cases of rapid disappearance, of large yacht yards demonstrates the rising attraction and the difficulties of the international nautical luxury business (speculation investments). Source:Yachts Magazine, Global Build Report 2004-2005, LuxMedia group.

Although the growth of orders in 2006 even Italy lost a few points despite benefiting from 37 new orders, by virtue of which it raised the performance, i.e. the total market share of the first four countries.

This decrease (see particularly the Netherlands and the USA) followed by an overall growth of the whole international order book is certainly the symptom of an increasing level of competitiveness on the luxury vessel market. It is also a result of the entry of new shipbuilding industries from the so called emerging countries, which until not long ago could be defined as of little importance in this sector. Basically, the exceptional increase of 144 orders in 2005 resulted in a favorable outcome for numerous yards not belonging to the four major countries.

But a much more interesting aspect is the presumed growth trend, see Figure 2. The 'other' countries, which do not include New Zealand since the latter is not a low labor cost country, are experiencing an increase that appears to be unstoppable; it is countered only by the continuous growth trend of just one country, namely Italy, while the USA, Germany, Holland, the UK and New Zealand seem to be undergoing a marked decline, at least as far as number of orders is concerned.

Maybe, in few years, the newcomers (the 'others') will outstrip European yards – among which Italian yards – and those of America.

The great fame of Italian production in this sector to some extent shields it from the challenge of competition by newcomers. However, the great Italian shipyards are already preparing to defend themselves against the danger represented by the low prices of the newcomers (see the project to form 'platforms', consolidation of the larger yards, diversification in the field of superyacht services, marinas, hotels etc).

But in Italy, in particular, there exists another problem for the larger yards. The problem consists in the fact that the greatest competition faced by the major Italian yards comes not only from abroad, that is to say from the traditional American, European, New Zealand competitors and the new comers, but also from within Italy itself.

A considerable number of small/medium-sized Italian yards have been set up in the wake of the rise in worldwide demand and the success of the Italian style. The presence, mentioned earlier, of numerous medium-sized yards producing superyachts in Viareggio is a very obvious example of this phenomenon.

Tabel 4: Trend of market shares of the main production countries.

	Italy	USA	Holland	UK	New Zealand	Others
2000	31,55%	24,61%	15,77%	2,52%	5,36%	20,19%
2001	32,71%	20,09%	12,38%	3,97%	3,50%	27,34%
2002	33,66%	19,60%	12,08%	3,56%	4,36%	26,73%
2003	37,01%	17,05%	13,51%	7,07%	4,57%	20,79%
2004	37,28%	14,99%	9,66%	6,51%	4,34%	27,22%
2005	38,25%	14,90%	7,37%	8,91%	3,38%	27,19%
2006	37,79%	12,35%	7,56%	7,99%	2,33%	31,98%

Source: Our elaboration from UCINA, ICOMIA data.

Tabel 5: Annual Growth %.

	World	Italy	USA	Holland	UK	New Zealand	Others
2000							
2001	35,02%	40,00%	10,3%	6,0%	112,5%	-11,8%	60,3%
2002	17,99%	21,43%	15,1%	15,1%	5,9%	46,7%	15,4%
2003	-4,75%	4,71%	-17,2%	6,6%	88,9%	0,0%	-25,9%
2004	5,41%	6,18%	-7,3%	-24,6%	-2,9%	0,0%	38,0%
2005	28,40%	31,75%	27,6%	-2,0%	75,8%	0,0%	28,3%
2006	5,68%	4,42%	-12,4%	8,3%	-5,2%	-27,3%	24,3%

Source: Our elaboration from UCINA, ICOMIA data.

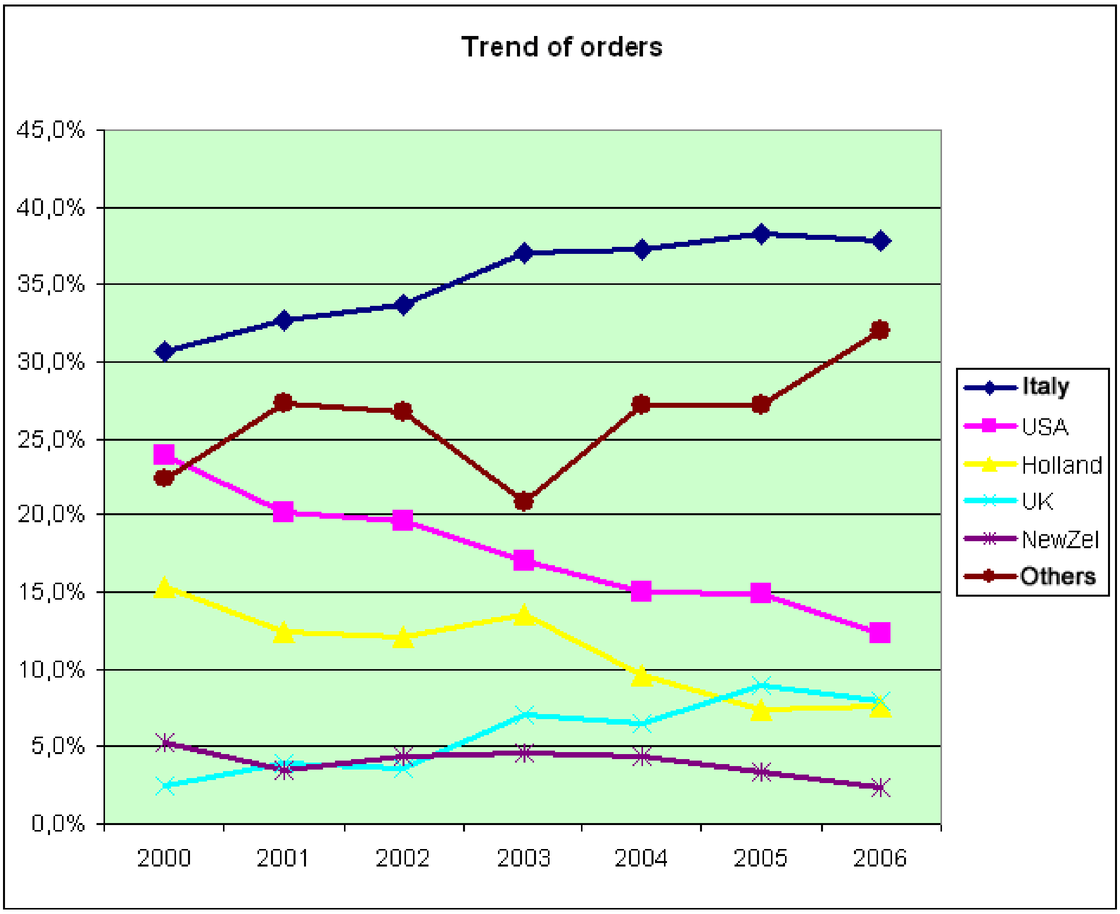

Figure 2: Trend of orders.
Source: Our elaboration.

The table demonstrates clearly that the 'others' show a steep linear trend in % (from 2003). The extrapolation suggests that Italy could be overtaken in a short time:
2004: +38, 2005: +39, 2006: + 43.

Summarizing: superyacht builders display the following characteristics:

A - All yards seek to achieve an optimal size and organization.

B - A production setup in which superyachts are products resulting from assembly by experienced small-sized accessories manufacturers or outsourced businesses. These constitute the so-called pipeline that produces for yards, and it is undergoing rapid development in newcomer countries as demonstrated by the earlier cited example of Taiwan.

C - A structural model of heterogeneous oligopoly, which however is even more competitive because each enterprise deploys its optimal choice given the strategy of its rivals, but acts within an environment where neither a predatory price policy nor collusive activities are possible as long as all the stronger yards in EU and USA are facing the same production conditions and specialized high cost labor markets, as has indeed been the case to date. On the one hand, megayachts require a minimum scale of efficient high capital intensity production, yet at the same time economies of scale do not occur or are low (but it is possible that it will change with the new 'platforms'). The markets are affected by the fierce competition arising from the need to produce yachts with highly differentiated production features, where product uniqueness and luxury are considered outstanding features and play a overwhelmingly important role.

Thus while the market structure can be described as heterogeneous oligopoly, it is of an ambiguous type, which cannot make use of all the typical instruments of this structure. In this framework it is of particular relevance that US and EU yards are becoming under attack by the newcomers who are setting their prices far lower (predatory policy).

As a consequence it is interesting to inquire into the type of circumstances that could trigger a fall in demand for luxury.

The following aspects can be mentioned for all countries:

- a sudden change in luxury tastes;
- an excessive numerosity of yards, as excessive supply would result in a decreased perception of "uniqueness" by the purchaser.

And for USA and EU shipyards:

- an extremely strong pressure on prices, with true predatory features, by the new Arab, Chinese and other competitors in parallel with *qualitative* development of productions in low cost countries.

In the complex scenarios outlined above, it is of interest to determine whether the large American, European - among which the Italian- shipyards would consider it more advantageous to set more binding conditions on the cluster enterprises.

At present particularly in Italy top level yards adopt a mixed organization, awarding priority to close relations with outsourced groups of trusted and highly skilled first-level but partially verticalized suppliers, also maintaining horizontal relations with businesses that form part of the clusters or districts.

If stiffer competition or a decline in demand or, above all, sharply predatory prices were to create severely adverse conditions, the large companies in EU and USA and particularly in Italy declare that they are directing efforts towards reducing costs by:

- adopting production systems similar to those characterizing the automobile sector;
- carrying out a further process of selection of suppliers/outsourced enterprises retaining close, cooperative links only with the best suppliers,
- imposing to SMEs very strict times scales, more tightly controlled specifications moving towards a more vertically integrated organization
- buying abroad all or part of accessories from the more esteemed SMEs that are developing in the newcomer countries or/and accept to expand relations with international suppliers
- delocalizing all or part of production in emerging countries. This is, for instance, the choice opted for by Codecasa and by Perini (the latter having produced the 'Falcon' entirely in Turkey. Maltese Falcon is a $ 100 million (source: http://news.com.com/2300-1008_3-6094519-1.html) sailing-yacht boasting top technology for an 87,5 meter yacht that evokes the image of nineteenth-century ships. The ship has fifteen square sails (five per mast) which open in six minutes. This example indicated the level of expertise achieved by some yards where Italy has delocalized and put considerable effort into increasing know-how.

What can be proposed in order to safeguard Italian SMEs and their creative flare? Experience shows that these small enterprises are reluctant to work in some form of associative arrangement or to cooperate, or engage in acquisitions in order to achieve medium-large size. Independence is their buzz word and perhaps their strength..

However we note that the majority of accessories manufacturers/outsourced enterprises, in particular those in the Viareggio area and generally in Italy and in high cost countries, have already acquired international renown, they are branded and have high export levels (as much as 100%, Cazzaniga Francesetti, 2005). This points to a possible opportunity for accessories manufacturers/outsourced enterprises. It could be based on a strategy of even greater internationalization of the products of the cluster.

Enhancing the international image of the accessories manufacturers/outsourced enterprises would perhaps become the only alternative open to these small businesses as a means to counter the pressure towards verticalization and rough selection.

4. Conclusion

Examination of this rather special niche sector of superyacht production yards reveals that precisely because it has experienced a prolonged period of growth in demand, a series of new phenomena have arisen.

The pressure on prices brought about by the new entrants (but also the possibility that demand may in the future suffer a decline - and the decline could be abrupt) seems to be leading towards:

- fierce selection among EU and US yards, from which only Italy has so far escaped unscathed;
- a situation whereby the low labor cost emergent countries are taking over greater and greater market shares;
- a stronger de-localization, among other defense methods, of Western and Italian yards;
- the development of technological platforms by the major yards (which are undergoing pronounced consolidation); such platforms are likely to result in savings on costs, verticalization of relations with SMEs and a strong increase in production delocalization)

Finally, a fresh look should be taken at the possible means of defense of cluster SMEs as well as Western and Italian districts operating in the field of large yacht production.

References

Becattini G., 1989, Riflessioni sul distretto industriale marshalliano come concetto socio-economico, in *Stato e Mercato* n.25

Bendall H.B., Cazzaniga Francesetti D., 2003, *Cantieristica commerciale e da diporto: strutture e innovazione,* in *L'industria* n.4, Il Mulino, Bologna¸.

Cazzaniga Francesetti D., 2005, *Struttura e problemi dei cantieri commerciali e da diporto*. F.Angeli, Milano

Cazzaniga Francesetti, D., 2006, Superyacht made in China. In : *La Gazzetta Marittima* , 29 Marzo

ICOMIA, Icomia Boating Industry Statistics www.icomia.com/statistics/samples/A1.pdf

Luxmedia, 2006, *Global Build Report*, 2005-6, Luxmedia Group .

Merrill Lynch, http://www.capgemini.com

Nastasi T., 2005, Superyacht Industry International Competitive Benchmarking, In *Nautica*

PricewaterhouseCoopers, 2006, *Global Private Banking/Wealth Management Survey 2006*
UCINA, *La nautica in cifre*, several years

European Transport \ Trasporti Europei n. 38 (2008): 47-60

The realistic prospects of upgrading international transport axes in the Balkan Area

Evangelos Matsoukis [1*]

[1] Transport and Traffic Eng. Study Unit
University of Patras
Patras, 26500, Greece

Abstract

The development of upgraded transport networks in the SEE (South East European) region(Balkan), connected and compatible with the corresponding EU(European Union) internal networks and those of the neighbouring countries, is an important means of improving links within the region and integrating the countries of the area into the political and economic mainstream of Europe.

However,Balkan countries seem to have many problems in developing such upgraded transport networks The quality of infrastructure in the region at present remains inadequate to support a significant increase in transport flows. While in this part of Europe, after a long period of political unrest and reform, transport flows are increasing in an impressive way and solutions are urgently needed…

The EU has gone through extensive planning exercises resulting in trans-european networks for the European Union and the accession countries. The participation of the EU derives from the EU´s as well as the countries' long term vision on accession of all countries of the area to the European Union.

This paper starts with a brief review of the EU efforts to develop a common transport policy in the area. Then, it describes in detail the HLG-SEE(High Level Group-SEE) work , which may be considered as an important effort in the above mentioned planning process in recent years. The proposed methodology by the HLG to identify major transnational axes is outlined . The outcome of this exercise is given, together with the final proposals made.

Following this, the paper proceeds to an investigation of the current situation and of the future prospects of the Balkan international transport axes , on the basis of the experience gained until now, and the reality applying to this SEE area.

In concluding, the need is stressed, in the name of both the environment and safety, to address urgently the problem of the Balkan's *road network*, since the vast majority chooses road as the preferred means of transport for freight and passengers alike. This seems to be a first priority to bring fast progress in this still underdeveloped SEE area and to promote European integration.

Keywords: International transport axes; Balkan countries; South East Europe; Trans-European networks; EU High Level Group.

---

* Corresponding author: Evangelos Matsoukis (Emats.glyfada@tee.gr)

1. Introduction

In reaching the end of the first decade of the 21st century, most politicians in the Balkan countries seem to have a vision: they seek and pursue a new status for the transport infrastructure of the region, where transportation flows traverse without problems this SouthEast Area of Europe(Balkan) , by use of e.g. 6- lane motorways, and with very few bottlenecks at the various border lines, where vehicles are transferred from country to country!

The reality however is completely different, and we are far away from reaching this status. Vehicles wait for hours in the borders of the various Balkan countries, delayed due to the time-consuming processes of control. The numerous plans for the upgrade of transport networks in the Balkans on the basis of the models of the EU, with international financing, are not making progress, in contrary they are already delayed.

In the meantime transport flows in the region are increasing rapidly in recent years, because, after a decade of political unrest,(1998-2006) political stability seems to return in the Balkans. Especially the volumes of transported goods are increasing in an impressive way.

The quality of infrastructure in the region is still inadequate to support - or indeed facilitate - this significant increase in trade. The following Table 1 is quite characteristic.

Table 1: Comparison of Basic Infrastructure Development Indicators

	Category	*Balkans*	*Central Europe*	*European Union*
1.	Road network			
1.1.	Density	41.06	105.04	100
1.2.	Paved main road network, percent	59.82	67.04	100
2.	Railway network			
2.1.	Density (standard gauge)	75.62	139.20	100
2.2.	Electrification (standard gauge), percent	86.30	89.93	100
3.	Telecommunication network			
3.1.	Main connections per 100 inhabitants	37.9	50.4	100
3.2.	Mobile telephony connections per 100 inhabitants	7.0	30.0	100
4.	Energy network			
4.1.	Electricity production per inhabitant	45.6	66.0	100
4.2.	Natural gas consumption per inhabitant	61.2	58.70	100
5.	Education			
5.1.	Public expenditure as a percentage of GNP	73.97	92.12	100
5.2.	Public expenditure per student in tertiary education as a percentage of GNP per capita	86.26	124.50	100
6.	Health			
6.1.	Public expenditure as a percentage of GDP	85.57	107.21	100
6.2.	Hospital beds per 1 ,000 inhabitants	81.20	102.56	100
7.	Science and technology infrastructure			
7.1.	R&D expenditure as a percentage of GNP	67.80	65.54	100

Source: P. Skayannis, "Infrastructure Comparisons in Transition Countries: A New North-South Divide in Europe?" in *The Development of the Balkan Region,* ed. G. Petrakos and S. Totev

Let us have a more thorough look:

Roads: Most of the main roads used for freight were built in the 1970s and 1980s, and have been poorly maintained since then owing to a lack of resources. In addition, many routes in ex-Yugoslavia suffered war damage, either directly through bombing and landmines, or as a result of heavy tank traffic, which the roads were not designed to withstand. However, the quality of roads in the Balkans varies enormously: between e.g. Bulgaria and Croatia, where good new motorways have been built recently and more are under construction, and Albania, where few roads are asphalted and almost all are in very poor condition.

Rail: Most lines need modernisation, and there is a severe backlog in maintenance which, in some areas, reduces the operational capacity and travel speed substantially. 85% of the network is single track, and only 10 % is in good condition. It should also be underlined that the railway companies in general will require major restructuring to provide efficiently adequate transport services. In some areas, incompatible technical track specifications also slow down goods transit; less than 10% of track in the Western Balkans is electrified (compared to around two-thirds in Bulgaria). The railways are under state ownership throughout the region, although Croatian Railways is slated for privatisation. Border crossings represent another major bottleneck, largely reflecting a lack of computerised customs facilities or cooperation between neighbouring countries' border-guards. There are also costs and uncertainty arising from visa requirements for drivers and corruption in the customs services.

Investment Priorities: The rehabilitation of existing infrastructure and the construction of new links are priorities not just for national governments, but also for the international organisations providing aid, loans and transition assistance to the region. Faster and safer road and rail links would bring a number of benefits: better links would facilitate trade, both within the region and within the EU, which accounts for more than 50% of exports. In particular, faster freight would create more opportunities to export such perishables as agricultural produce. Foreign investors would be more attracted to the region if goods could be cheaply, reliably and quickly exported to richer markets in the West and developing markets in the East.

Tourism is a key growth industry in the region. However, the summer season always brings traffic congestion. More investment is needed in roads - and airports - to improve access.

Financing Frustrations: Most governments in the region lack the resources required to build and maintain roads, and rely heavily on aid and loans from the EU, the European Investment Bank, the World Bank and the European Bank for Reconstruction and Development. All these institutions are heavily involved in co-financing road repair and rebuilding. Routes on the main European 'transport corridors' crossing the Balkans -- notably north-south Corridor X, running from Austria to Greece through Belgrade, and east-west Corridor VIII, running from Durres in Albania on the Adriatic, through FYROM to Bulgaria's Black Sea coast - receive priority.

However, the transport of goods across the region remains costly, over-regulated and inefficient. Moreover, the creation of four new states in SEE has resulted in a multiplicity of international borders/check-points and of decision-making centres for planning, regulating and investing in the transport sector with negative repercussions for integrated regional economic development and trade.

2. Brief history of EU efforts towards a common transport policy for the region

A common transport policy for south-east Europe dates back to 1999, when the Stability Pact for South-East Europe was set up at the initiative of the European Commission(EC).

The western Balkans were gradually moving out of war and the region was regaining its potential within Europe. Hence the growing presence of the EU in the region beginning in 2000, in a number of policy areas such as energy and transport, with an overall promising roadmap for enlargement.

The participation of the EC derived from the EU´s as well as the countries' long term vision on accession of all countries to the EU which required to work towards the adoption of EU´s goals and strategies as well as to satisfy its acquis communitaire in the transport sector.

At the end of 2001 the EC finalised its strategy and released the document "Transport and Energy Infrastructure for South Eastern Europe" (European Commission2001). This strategy, which has been discussed and agreed with the countries of the region and with relevant international agencies and IFIs, constitutes the framework of an ongoing process to promote regional cooperation among the countries of the Region, facilitate coordination between donors and allow adequate prioritisation of the regional infrastructure investments in Southeast Europe" (quote from SEETO, 2006).

In 2002 the TIRS (Transport Infrastructure Regional Study) determined the SEE Core Transport. (Agence Francaise de developpement (financier)/European Conference of Ministers of transport, 2002)

In mid-2003, the "Regional Balkans Infrastructure Study Transport - REBIS Transport" was released (European Commission financier, 2003). This project aimed at preparing investment plans for transport infrastructures and at preparing pre-feasibility studies for selected project proposals, prior to investment decisions. The project focused on the development of the Core Network based on the previous study (TIRS). It is broadly composed of the Trans European Transport Corridors and of the links between capitals of the Region and to capitals of the Regional Balkans Infrastructure Study Transport (REBIS Transport). However this study was based on data up to 2000, when there existed no standard trends in socio-economic development of some countries e.g. Serbia and Montenegro. Predicted GPD growth rates were from 4 to 4.5%, while in previous years they were much higher (for example, higher than 6% in Serbia).

An assessment of the Core Network was made through TINA methodology (2004), which provided the status-at that time- of completed sections, ongoing and future projects, missing links and bottlenecks including those of administrative and technical nature.

This work also produced 20 pre-feasibility studies of selected projects towards alleviating bottlenecks and upgrading the Core network to "EU-standards" (European Commission/External relations directorate general Regional Strategy Paper, 2002-2006).

In mid-2004, the EE founded the HLG -High Level Group on the extension of the major trans-European transport axes to the neighbouring countries and regions. The HLG followed the ministerial seminar organised in June 2004 in Santiago de Compostela, Spain (European Commission HLG, 2004). The objective of the HLG was to recommend how to extend the major trans-European transport axes to the neighbouring countries and to identify priority projects on these axes. A particular HLG for the SEE region was set up.

In September 2005 the final proposals decided by the EC on the basis of the HLG project, were released. (European Commission HLG, 2005).

There has also been much progress with the establishment of an EU Network Steering Committee (NSC), composed of high level representatives of the participants, which co-ordinates the joint work of the MoU's (Memorandum of Understanding, 2005) and, the establishment of a South East Europe Transport Observatory (SEETO, 2005). The core mandate of SEETO is to assist the NSC in implementing the MoU to ensure that the signatories co-operate on the development of the main and ancillary infrastructure on the Network and enhance policies in this area which facilitate such development.

In April 2006 the First Core Regional Transport Network Development Plan 2006-2010 was presented and accepted by EC (SEETO, 2005).

In December 2006 Mr Jaques Barrot and EC Ministers accepted the 2007- 2011 SEE Core Regional Transport Network Development Plan (SEETO, 2006).

3. The main aspects of the HLG -SEE region work

The HLG project can be considered as the most serious effort in recent years to promote transport in the wider Balkan Area. The author of this article, had the occasion to participate as Greece's representative in this HLG for the SEE region (Balkans).

This paragraph outlines the methodology that was proposed by HLG for adoption and that provided the framework for the exercise to identify and select potential axes and projects on the SEE region. The proposed methodology consisted of two steps:

- <u>Identification of major transport axes connecting the EU with the broader SEE region</u>.
- <u>Selection of priority projects on these major axes</u> that were feasible and which demonstrated best value for money in terms of their economic, social and environmental impact.

3.1. Step 1: Criteria proposed for identifying major axes connecting the EU with its neighbours

The first step of the methodology aimed at identifying a limited set, some 5-7, of priority transport axes, which connect the EU with the neighbouring countries of the SEE region and which are particularly relevant for international transport. The concept of major transnational axis was seen as important to focus efforts and to get countries together in a cooperative international setting.

The axes would in many cases have *a multimodal character* in addition to their Pan-European dimension, being used by traffic between the European Union and the neighbouring countries. Special attention would be granted *to nodal points*, such as ports given their potential strategic role as industrial and logistic platforms. The networks that have been the subject of international agreements and other joint decisions and actions should be considered as the starting point for the whole exercise.

The following two aspects were proposed for the identification of priority axes connecting the EU with the neighbouring countries or broader regions:

- *Pan-European interest* - a priority axis should facilitate and stimulate the development of exchanges between the European Union and its neighbours by extending the major TEN axes to the neighbouring countries or regions, taking due account of existing priority reference networks and corridors.
- *Functional dimension* - a priority axis should be an important route for international traffic flows between the EU and the neighbouring countries or regions, in particular in the longer term. In addition, a priority axis can be a route that allows traffic to avoid a major environmental bottleneck or barrier. This dimension should be assessed using one the following three criteria:
  - amount and share of <u>international traffic</u>, today and forecast for 2020, with origin or destination in the EU and a neighbouring country or region, measured e.g. in tonne and passenger kilometres or vehicles crossing a border, and as % of overall long-distance traffic; or
  - volume of <u>transit traffic</u>, in the current situation and estimated for 2020, with origin or destination in the Union and using the infrastructure of the neighbouring country or region; or
  - the axis offers an <u>alternative</u>, which is potentially much shorter (less costly to users), environmentally friendlier or safer than the alternative, established route.

3.2. Step 2: Criteria for selecting priority projects

At a second step, priority projects on the major transnational axes, as identified according to the objectives and criteria presented in the previous section, will be selected paying particular attention to the most pressing bottlenecks for international traffic. As funding transport investments is inevitably a difficult issue, a proper evaluation prior to putting forward projects is fundamental.

A two-stage procedure was thus proposed for project selection.

<u>*First stage - pre-selection*</u>

The first stage aimed at pre-selecting a restricted number of projects worthy of being examined in detail by the Group. The methodology should be simple and allow a rapid analysis of project proposals. This should be done through the elimination of those projects not meeting all of the following three criteria:

- the project should form part of one of the <u>*priority transnational axes*</u>, as identified by the Group in step 1, taking notably due account of projects which cross or circumvent natural barriers, alleviate congestion or other bottlenecks or offer safer or environmentally friendlier alternatives to main corridors used today;
- to eliminate projects which are too small or too regional in their character to merit inclusion, the project should be of sufficient <u>*significance*</u>. The particular situation of the countries concerned would, however, be taken into account.

To avoid a multitude of small projects without significant impact, the cost of each infrastructure project should be above the indicative threshold of [0.15%] of the GDP of the country/region concerned. Lower indicative thresholds may, however, exceptionally be approved for the rehabilitation of existing infrastructure, for traffic management systems, including security systems, or for projects which promote maritime transport or transport using inland waterways or which address environmental or safety concerns.

The technical solution proposed should be more cost efficient in reaching its stated objectives than alternative technical options, including e.g. type of action (new construction/rehabilitation; motorway/dual/single carriageway) or investments in other modal routes (motorway of the sea/land based solution).

- There should be a *firm commitment* of the country or region concerned to implement the project, notably by checking whether the project will be subject to national selection tests and relevant international conventions:
  - the project is scheduled in national transport plans with the start of works prior to 2010 and completion by 2020 at the latest;
  - realistic financial plan, which indicates the various funding sources, including, in particular, the amount of national and international funding and where appropriate private funds.

Second stage - evaluation

In the second stage, the objective is to identify those projects, which contribute most to balanced sustainable development in terms of their economic, environmental and social dimension using the following three criteria:

- improving economic efficiency - notably cost savings, including time savings, to international users and operators/firms of the transport system taking into account possible charges paid for the infrastructure use. Impact on economic growth and employment;
- enhancing environmental sustainability of the transport system - Reduction in air pollution, noise, green house gases and other environmental impacts such as biodiversity, e.g. through changes in the existing modal shift, re-routing to environmentally friendlier modes or infrastructures or through reduction in congestion;
- improving transport safety and security - Reduction in the number and severity of accidents caused by international traffic and in security incidents to international operators, e.g. through modal shift or re-routing to safer modes or infrastructure.

The above criteria should be calculated for the situation with the project proposed and compared to a situation without the project. The impacts, calculated in monetary terms as far as possible, should be checked against the investment, maintenance and running costs of the project. The net benefits should be significantly positive overall, only projects with a sufficiently high internal rate of return [>6%] will be considered, and to the extent possible for each separate criterion.

It is also important to stress that the projects proposed should respect international conventions and that environmental assessment, procurement procedures etc. are carried out in accordance with national legislation, donors' funding rules and best international practice.

3.3. Results: the decisions taken and the proposals made

On the basis of the above, HLG-SEE region submitted its proposals. In line with the mandate given to it, the HLG- EU decided to adopt five multimodal transport axes at its sixth plenary meeting in September 2005.

All of the five axes comprised one or more branches reflecting the volumes of international traffic and the forecast for 2020 and ensuring connectivity between the neighbouring regions and the trans-European networks of the EU.

Out of the five, the transnational axis adopted by the Group and referring to the SEE region is the so-called South Eastern axis.

This South Eastern axis links the EU through the Balkans and Turkey to the Caucasus and the Caspian Sea as well as to Egypt and the Red Sea. Access links to the Balkan countries as well connections towards Russia, Iran and Iraq and the Persian Gulf are also foreseen .The alignment of these connections is the following:

- *Multimodal connection* Salzburg - Ljubljana - Zagreb/Budapest - Belgrade - Nis, including the following connections
- Sofia - Istanbul - Ankara - Georgia/Armenia - Azerbaijan (Traceca)
- Skopje - Thessaloniki
- *Multimodal connection* Budapest - Sarajevo - Ploce
- *Multimodal connections* Bari/Brindisi - Durres/Vlora - Tirana - Skopje - Sofia - Burgas/Varna
- *Inland waterways* Danube -Sava

In addition to the above connections and branches, Austria supported by Croatia and Bosnia and Herzegovina raised the so called Pyhrin corridor linking Berlin to Zagreb and connecting to the TEN priority project no 22 and the Pan-European Corridor X. UNMIK/Kosovo, Serbia and Montenegro and Albania stressed the importance of the Balkan regional core network in providing access to the main axes.

It should be mentioned that the parties which actually took place in this process were: Albania, Bosnia/Hertzegovina, Serbia, Montenegro, Croatia, FYROM, UNMIK/Kosovo, Italy, Greece and Slovenia - the last three were already EU members, Romania and Bulgaria - the latter joined EU in 2007 and Turkey.

4. The current situation and the future prospects

4.1. Current situation

Today the EU remains the major and rather unique promoter of the common transport policy for south-east Europe.

There are still four conspicuous problems:

- Inadequate and unsafe road and rail networks, leading in many places to delays, congestion, pollution and accidents. Most major arteries in the Balkan are unable to handle the EU standard of 11.5 tonnes per axle. Road and rail safety also needs urgent attention: Serbia and Croatia's road casualties per 1,000 population are up to four times the rates found in the UK, a performance gap which is increasing every year.

- No stable financing mechanisms: According to official sources, 70% of major road and rail axes in the region need improvement or replacement.. However, basic maintenance of the region's road and rail networks requires levels of funding which are simply not available from the public sector.
- Discrepancy between the EU and national governments in terms of prioritizing particular projects and modalities.
- Incomplete regulation with the risk of unfair competition with the EU-27. For road haulage, checks on admission to the occupation, driving times and rest periods are woefully inadequate. In the medium term, the Balkan Countries are facing or will face the challenge of implementing and enforcing a large body of transport *acquis communuautaire* comprising several hundred regulations, directives and decisions. The road transport *acquis* is particularly extensive, covering market access and social, technical, fiscal, safety and environmental requirements.

Also, the level of intra-regional co-operation – a vital element for the effective development of any common policy and, above all, for transport – remains rather poor, so the EU has tried to compensate for this with various strategic actions. For instance, it has strived to tighten up co-ordination and to secure a greater commitment of southeast European countries in the area of the common transport policy. This has implied the gradual replacement (Stability Pact for South East Europe, 2006) of all fora that had been involved in regional transport infrastructure activities with two main EU co-ordinated structures. These two main policy-making and implementation levels are:

- the Infrastructure Steering Group(ISG) run by the European Commission and the World Bank Office for SEE (Brussels) and made up of the European Commission, the World Bank, the Council of Europe Development Bank, the EBRD, the EIB and the Stability Pact for South-East Europe;
- the South-East European Transport Observatory(SEETO), which includes the European Commission, the Banks (IMF, the World Bank, EIB and EBRD) and representatives of the western Balkan countries.

The ISG gives the possibility to the EC and the banks to discuss and co-ordinate policies before disseminating them, via SEETO, within the region.

4.2. Future general prospects

There is no doubt that the EU's main objective for the SEE area is to make sure that a common transport policy for the region will be established, which will support rather than challenge regional cohesion as well as social, economic and political stability. For the Balkans in particular, regional stability depends on the steadiness of each and every component country.

Moreover, any threat to social/economic/political instability may easily have a spill-over effect and compromise the fine balance that has been, with great effort, achieved so far in the region and its vicinity.

In developing a common transport policy for south-east Europe, the declared goals of the EU are to contribute to economic growth, stability and cohesion in this part of Europe that has been heavily confronted with conflict and recession.

However generous these initial goals, one cannot ignore that there is an ever-increasing gap between the purely economic policy objectives and the context of broader sustainability. Thus, while there is an unprecedented level of regional mobilisation towards the implementation of a common regional transport policy for southeast Europe, there has been certainly no matching effort in other areas, e.g.the social policy area.

In July 2007 ,the newly enlarged and amended Central European Free Trade Agreement (CEFTA 2006) came into force, for five parties in South Eastern Europe - Albania, FYROM, Moldova, Montenegro and UNMIK/Kosovo (European Commission, 2007).

This ambitious and far-reaching agreement was signed by the five parties plus Bosnia and Herzegovina, Croatia and Serbia in December 2006 following several months of intensive negotiations chaired by the Stability Pact and supported by the European Commission. In addition to harmonising the trade regime among the parties, the agreement also includes new areas of trade policy such as government procurement and intellectual property, with profound effects on transport in the area.

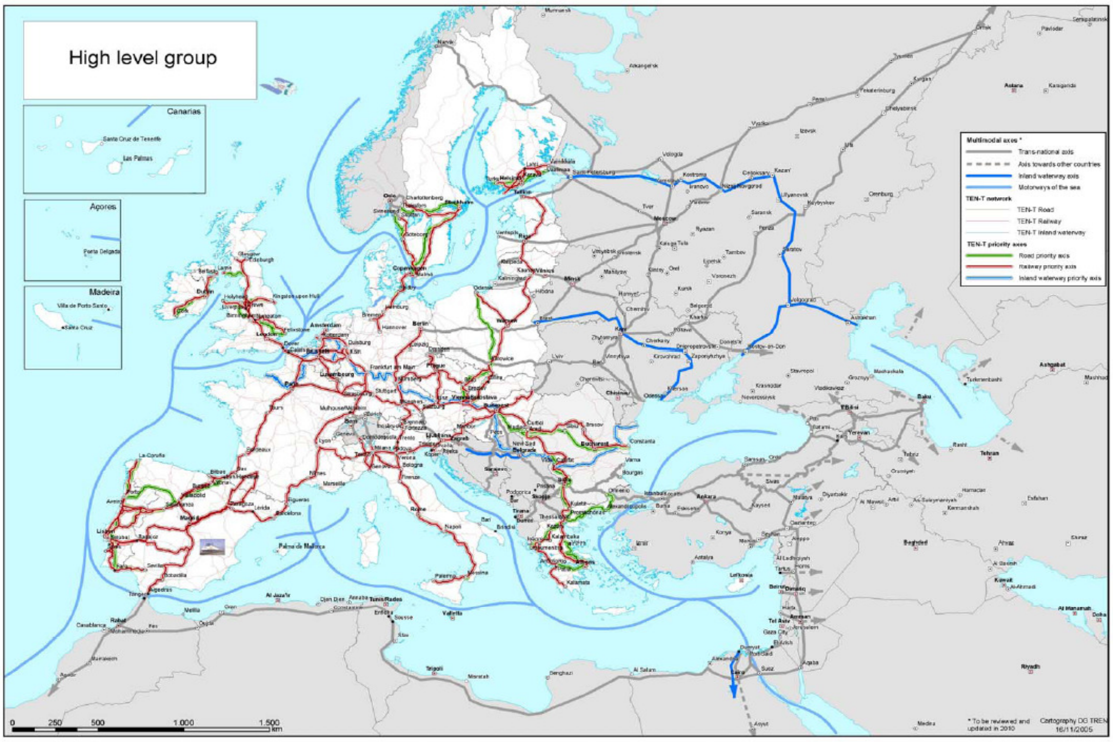

Figure 1: The HLG final proposals

4.3. Emphasis on road transport

The EU does not leave much space for road transport, after all it is the general EU approach to augment other transport means, as e.g. rail and sea transport.

In contrast, it is in the 11 Balkan countries that form the Balkan sub-continent, that the need for creation of new road links is most acute. In general, these countries have very few motorways. Helping them to built, as swiftly as possible, the network of motorways and expressways essential to the economic development of the whole region, should be a priority target for European funds. Other countries in their way towards development are acting the same way e.g. China, which is devoting 2.5% of its GDP to building over 5,000 kilometres of motorways every year, and giving clear priority to road over other forms of land transport as a key to the country's development. No greater service could be rendered to the 11 Balkan countries concerned.

To give an illustration, the 220 billion euros being mentioned in 2006 for Europe's "grand projects", over 80% of which are rail projects, would correspond to 20,000 kilometres of inter-city motorways in the 11 Balkan countries, far in excess of their needs (Eurostat, European Commission, 2006).

On the other hand, coverage by motorways of national territory is virtually complete in most of the Western EU countries. The bulk of the effort was completed in past decades, and there is no question of endlessly building more and more motorways.

The task remains to be completed, however, for other countries, such as the Balkan countries, which already are, or are will soon be, members of the EU.

The EU could thus contribute usefully to completing motorway coverage in the 11 countries and for the gaps which have to be to be filled.

As a roundtable of the ECMT (European Conference of Ministers of Transport) has found, there is no *inter-city* motorway in Western Europe with a current traffic volume of 100,000 vehicles per day, and a level of 80,000 is a maximum reached only on certain very rare sections.

In other words, four-lane motorways at most (or five lanes in exceptional circumstances) are adequate virtually everywhere in Europe for the foreseeable future. And, as the ECMT has pointed out again, it is physically possible to create such motorways everywhere, and the returns on such operations are always high when traffic is heavy.

Helping to built four–lane motorways, where they are needed in the Balkan, could therefore be a priority for the use of European funds.

A first essential factor – and one that carries no cost – would be a complete change of tone in the messages coming out of Brussels. In the future, these messages should recognise the reality of the specific needs of the Balkan countries, which most of the time can only be met by the car and the truck for there is no realistic alternative.

The already forecasted strong increase in road transport for the Balkan area in the coming years cannot be ignored. Therefore, sooner or later, most effort will be directed to the development of the *road network* in the area under consideration.

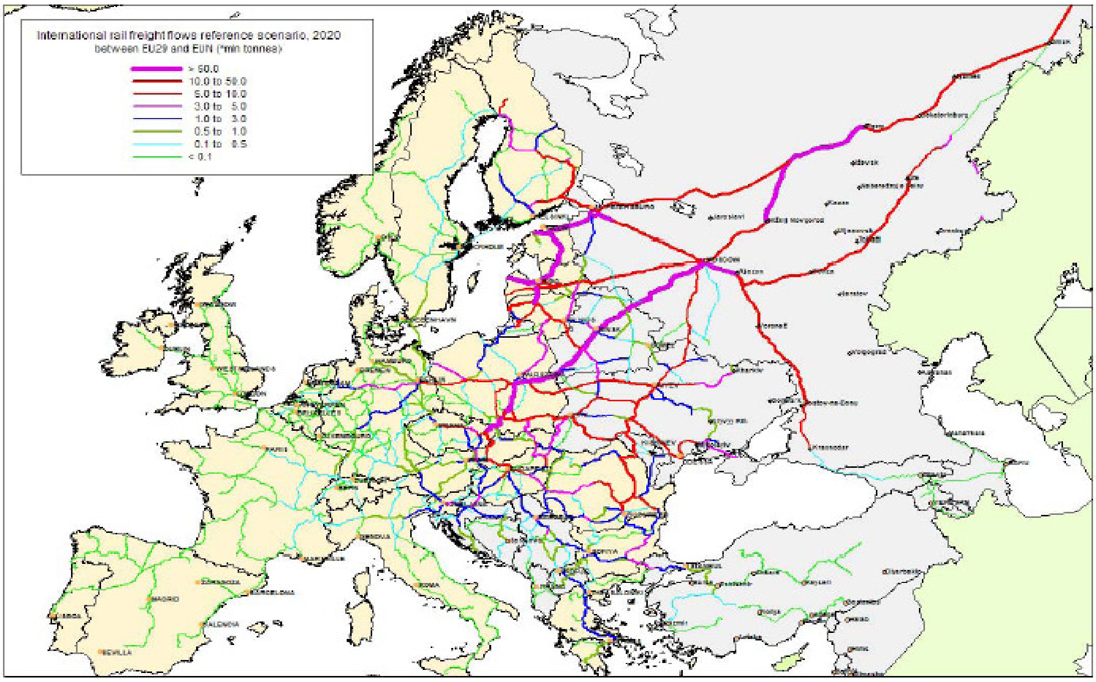

Figure 2: Internationale traffic volumes between EU, NEE and SEE neighbouring countries

5. Concluding Comments

1. The SEE Area(Balkan) cannot have accelerated economic growth without a corresponding growth in transport. Major transport axes connecting the EU with the broader SEE region must proceed without delay. The major transport axes that were defined by the EU and relevant bodies, and which demonstrated best value for money in terms of their economic, social and environmental impact should be prioritized.

2. On the other hand, the selection of a limited number of transport infrastructure projects of regional interest (selection of main road and rail axes, selection of seaports, etc.) with a subsequent aim of channelling investment towards pre-selected projects is not always the best way and a fair way to proceed. While national governments' projects should be stepping together with EU priorities.

3. There is a certain oscillation in defining the regional scope of EU regional transport policies. There are initiatives - such as SEETO - which include only the western Balkans. It may be that the Balkan countries have different levels of development, however, when we speak about Balkan we must consider all of the countries in a SEE context, i.e. the western Balkans plus Greece, Slovenia, Bulgaria, Romania, the Republic of Moldova, and Turkey.

4. In relation to the above and beyond that, to ensure long-term sustainability, EU transport policy for the Balkan must take into account a wide range of sustainability issues, such as the physical environment, safety and quality, security, social conditions and the financing of well-maintained infrastructure among others.

Consumer needs and consumer demand, market-based incentives, and robust financing plans must be guiding principles for investment in transport in the area, but this new generation of investment must seek to progressively facilitate the development of sustainable and less resource demanding alternatives to the current situation. (See The Region, 2005)

5. The EU approach is topped up by the strong presence in the region of the international financial institutions (the IMF and the World Bank). Much blunter recommendations are expected to come within their financial and technical assistance 'package' for SEE countries. e.g. a rather recent World Bank document in the Western Balkans (December 2005) contains a list of recommended timely railway reform measures to be implemented by each western Balkan country. Staff reductions, privatisation of the freight operator and closing loss-making local lines are some of the most frequently-recommended measures. It should be recalled these are necessary, but may not be easily welcomed by local populations (Cristina Tilling, 2006).

6. Most effort should be directed by the EC and relevant bodies involved in the SEE to the development of those of the axles that refer to *road transport* in the area under consideration.

References

1. European Commission (2001) "Transport and Energy infrastructure In South East Europe"
2. Agence Francaise de developpement (financier)/European Conference of Ministers of transport (2002) "Transport Infrastructure Regional Study (TIRS) in the Balkans". Prepared by Louis Berger, Paris.
3. European Commission/External relations directorate general Regional Strategy Paper 2002-2006; CARDS Assistance Programme to the Western Balkans ,Brussels.
4. European Commission financier (2003) " Regional Balkans Infrastructure Study ", Transport Final Report. Prepared by REBIS transport Joint venture, Brussels/Lyngby.
5. Memorandum of Understanding (2005) on the development of the South East Europe Core Regional Transport Network between the Ministers of Transport of Albania, Bosnia and Hercegovina, Croatia, Serbia and Montenegro, former Yugoslav Republic of Macedonia, UNMIK and the Vice president of the European Commission, Luxembourg.
6. World Bank (2004) "Reducing the 'Economic Distance' to Market - A Framework for the Development of the Transport System in South East Europe" ,Washington.
7. European Commission HLG (2004) "Extention of the major trans-European transport axes to the neighbouring countries and regions, Working Document "Methodology for the Identification of Major Transport Axes and Priority Projects", Brussels.
8. European Commission HLG (2005) "Extention of the major trans-European transport axes to the neighbouring countries and regions, Final Report "Objectives and Recommendations", Brussels.
9. European Commission, DG Energy and Transport (2003) "European energy and transport, trends to 2030", Brussels.
10. European Commission, DG Energy and Transport (2004) "Commission, proposal for a regulation on the general rules for the granting of Community financial aid in the field of TEN in energy and transport".
11. Eurostat, European Commission (2006) "Panorama of transport, statistical overview of transport in the EU".
12. European Commission (2007) "Announcement of the Central European Free Trade Agreement (CEFTA)".
13. SEETO (2006) "South East Europe Regional Development Plan 2007-2011".

14. SEETO (2005) South East Europe Core Regional Network Development Plan "Five Year Multi-annual Plan 2006 to 2010, Common problems - Sharing solutions"
15. Cristina Tilling (2006) "The EU common transport policy for south-east Europe - what makes it a factor of cohesion and sustainability?" South-East Europe Review 1/2006
16. The Region (2005). Comment: The Southeast European Transport Barrier: The Regional Agenda
17. Stability Pact for South East Europe (2006) "Energy and Regional Infrastructure Progress Report" Working Table II Meeting, Bucharest.

Abbreviations and Acronyms

EC = European Commission
EU = European Union
FYROM = the former Yugoslav Republic of Macedonia
IFI = International financing institution
ISG = Infrastructure steering group (of the Stability pact and the European Commission)
MoU = Memorandum of Understanding, a written document executed by the parties which establishes policies or procedures of mutual concern. It does not require either party to obligate funds and does not create a legally binding commitment
MoT = Ministry of Transport
pan-TEN = pan-European corridors, i.e. 10 international corridors beyond EU boundaries resulting from decisions reached on the occasion of pan-EuropeanConferences of Transport Ministers in Crete (1994) and in Helsinki (1997), aiming at a coherent efficient pan-European transport system and corridor related co-operation on transport policy.
REBIS = Regional Balkans Infrastructure Study - Transport
SAA = Stabilisation and Association Agreement
SCSP = Stability Pact for South Eastern Europe (also short Stability Pact)
SEE = South East Europe
SEETO = South East Europe Transport Observatory
TINA = Transport Infrastructure Needs Assessment
TIRS = Transport Infrastructure Regional Study in the Balkans
TTFSE = Transport and Trade Facilitation in South East Europe
UNMIK = United Nations Interim Administration Mission in Kosovo
UNMIK Kosovo = UNMIK and the provisional self-government
Western Balkans = General geographic term with various definitions, here equivalent to SEETO area (Albania, Bosnia & Herzegovina, Croatia, The Former Yugoslav Republic of Macedonia, Serbia, Montenegro and UNMIK/Kosovo)
CARDS = Community Assistance for Reconstruction, Development and Stabilisation
DG TREN = Directorate General for Transport and Energy
NC = National Coordinator(s)
SEETIS =South East Europe Transport Information System
SC =Steering Committee
TEN-T = Trans European Networks (Transport)

CEFTA = Central European Free Trade Agreement
ECMT = European Conference of Ministers of Transport
EBRD = European Bank for Reconstruction and Development
EIB = European Investmet Bank
IMF = International Monetary Fund

Think globally, act locally - reducing environmental impacts of transport

Regine Gerike[1*], Tina Gehlert[2], Falk Richter[1], Wolfram Schmidt[1]

[1] Chair of Transport Ecology - [2] Chair of Traffic and Transportation Psychology
Faculty of Transportation Sciences "Friedrich List"
Dresden Technical University

Abstract

This paper presents a pragmatic approach for reducing the environmental impacts of transport in the German Federal State Saxony. The aim is to use the potential of pricing measures for effectively reducing environmental impacts of transport. They are combined with less-effective but more accepted non-pricing measures in a policy package. The development of this approach starts with the calculation of the current external costs of transport in the case study area. Second, a policy package reducing these external costs is composed. Third, the development of the external costs is assessed and compared in two scenarios, a BAU-scenario and the policy scenario where measures reducing the environmental impacts of transport are implemented. Fourth, the public and political acceptability of this policy package are investigated. The results show that it is possible to develop a policy package that is effective for reducing the environmental impacts as well as acceptable to the public and politicians. Therefore, such a package approach is suitable to guide future political decisions and actions towards a more sustainable transport sector.

Keywords: Sustainability; Transport; Environmental impacts; External costs; Acceptability; Saxony.

---

1. Introduction

For several decades, European transport policy has sought to reduce the environmental impacts of transport and to support the concept of sustainability in the transport sector. Significant progress was made in different areas, especially in the development of new technology. However, the reductions in emission achieved by innovations were largely overcompensated by an increased transport performance.

Economic measures are regarded as a promising way for reducing the environmental impacts of transport. Such measures include not only direct operating (internal) costs but also costs resulting from environmental impacts, congestion, accidents etc. (the so-

* Corresponding author: regine.gerike@tu-dresden.de

called external costs). These external costs are not covered by travellers but are imposed on the whole society, other regions or future generations. As a result, current transport prices do not reflect the full costs caused by transport. However, these prices influence mobility behaviour by setting the financial scope in which people realise their travel. If they do not include the external cost components people will not include them into their travel decisions either. Thus, pricing measures for internalising the external costs, i.e. making the users pay for all the costs they cause, are a powerful instrument to change these decisions and reduce the environmental impacts of transport.

From a theoretical point of view the situation is clear. In practice, political initiatives to move forward with this approach are hardly implemented even though there are some notable exemptions, like the heavy good vehicle tax in Switzerland (Schade & Schlag, 2003). A reason could be that external costs, on which these internalisation measures are based, are highly variable and their calculation contains a number of uncertainties especially for long-term effects. Another and probably more important reason is the lack of acceptability. Politicians are reluctant to increase the costs for transport because they fear resistance from the public and the business community.

To overcome this problem a pragmatic approach was developed for reducing the environmental impacts of transport. The aim was to design a policy concept that is effective for reducing environmental effects as well as acceptable to the public and politicians. A package approach was used combining effective but less acceptable pricing measures with more acceptable non-pricing measures. These non-pricing measures do not directly internalise external costs but still contribute to the reduction of environmental effects of transport. Hence, we do not intend to stick to the internalisation principle in the classical economic sense but extend it and include non-pricing measures that support the reduction of environmental effects as well. This approach moves transport significantly towards sustainability as outlined in the national and international guidelines published for example by the ECMT/OECD and the European Commission (EC, 2006; ECMT 2004).[1]

This paper is based on a series of research projects that aimed at designing such a policy package for the German Federal State Saxony. The development process included the calculation of the current external costs of transport for the case study area. These costs can be seen as a mirror of the environmental impacts of transport which are transformed to monetary units. Second, a package of policy measures was designed to reduce these external costs and the environmental effects behind them. Third, the effectiveness of the policy package to reduce the environmental effects was assessed. This was done by modelling the impacts of the policy package and comparing them with a Business-As-Usual-scenario (BAU). The BAU-scenario is based on the assumption that no significant changes in transport policy will be implemented. The comparison between both scenarios also illustrates the savings for the economy if the policy package is implemented. Finally, the public and political acceptability of the policy package was assessed (see Becker, 2002; Gerike, 2000, 2004, 2006b).

The paper is organised in a similar way. The next section introduces the case study area which is the Free State of Saxony, its regional structure and local conditions. In section 3 the methodology to calculate the external costs is described, with special

[1] A sustainable transport development requires the consideration of further aspects besides the implementation of the polluter-pays-principle and the reduction of environmental effects of transport; see Gerike, 2007 for a comprehensive specification of the concept of sustainable transport development.

emphasis on the specifications for Saxony. Section 4 presents the current amount and spatial distribution of external costs of transport in Saxony. In section 5 the policy package composed to reduce these external costs and the environmental damages of transport is outlined. In section 6 the results of the modelling exercise are described. To illustrate the effectiveness of the policy package its impacts are compared with a BAU-scenario. In section 7 the methods and results for assessing the public and political acceptability of the policy scenario are presented. The paper finishes with a discussion of the results in section 8.

2. The regional structure of Saxony (Germany)

The Free State of Saxony is one of 16 Federal states of Germany situated in the eastern part of the country (see Figure 1). It covers an area of 18,415 km2 with approximately 4.3 million inhabitants.

Saxony, just as the other parts of Germany, is affected by serious demographic changes that affect passenger as well as freight transport (Scharfe, 2004; Saxon State Office of Statistics, 2003). Two main trends in the development of the population are observed.

First, the population is expected to decline due to low birth rates and employment migration to the western part of Germany. According to the population forecast of the Statistical Agency of Saxony, the number of inhabitants will decrease from 2000 to 2020 by 14 percent to approximately 3,786,000 inhabitants (Saxon State Office of Statistics, 2003). The differences in the density of the population will increase since sparsely populated rural areas will depopulate more strongly than the urban centres. Only for the biggest cities Leipzig and Dresden a slight increase in the population is predicted.

Second, the population is expected to grow older on average due to higher life-expectancy, as well as again low birth rates and migration (of mostly younger people). The mean age will increase from 43 years in 2000 to 49 years in 2020. In 2020 the share of people older than 65 years will be higher than 30 percent in almost one third of the Saxon municipalities.

Furthermore, Saxony is situated between various European centres and therefore used as transit route. In 2003 the share of foreign vehicles on Saxon motorways amounted to 20 percent and is expected to increase further (BASt, 2006).

These developments impose potential problems for the transport sector. There will be no significant decrease in transport volumes but fewer taxpayers covering the costs for the maintenance of transport infrastructure.

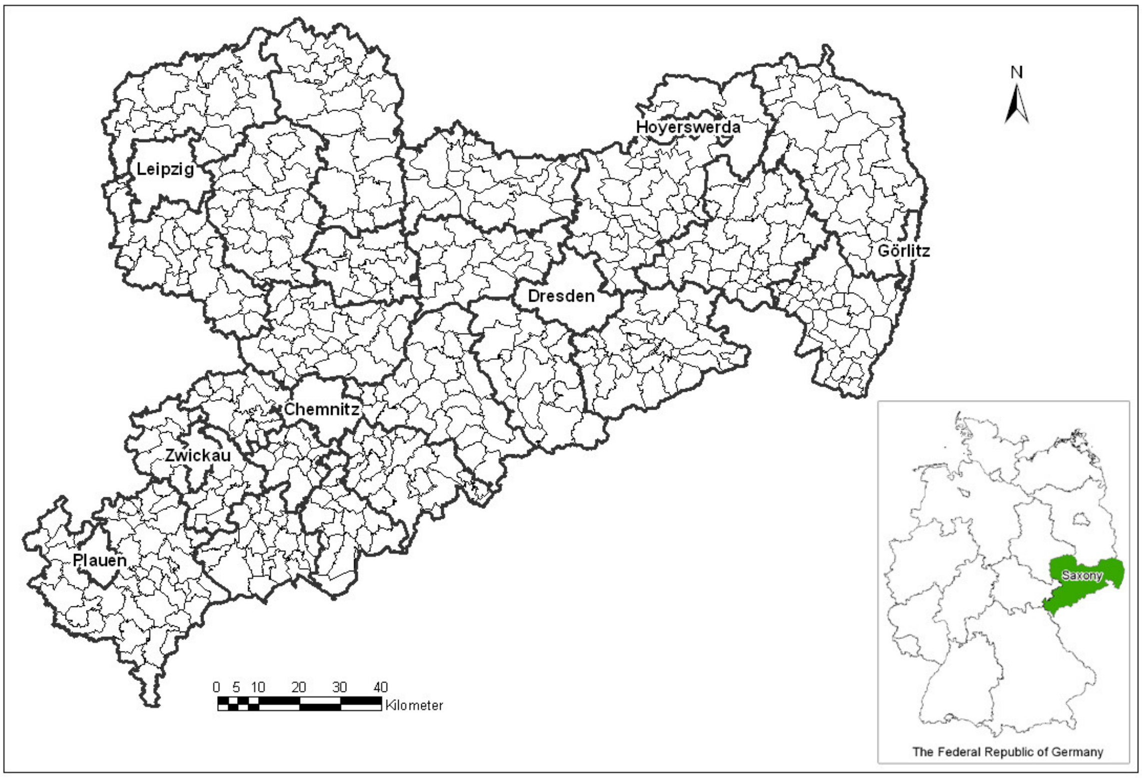

Figure 1: The Free State of Saxony: Regional administration.

3. Methodology for calculating external costs

The methodology used for calculating externals costs of transport in Saxony was based mainly on the studies carried out by Infras/IWW (Infras/IWW, 2000, 2004), the EU-projects UNITE (Nash, 2003) and ExternE (Bickel, 2005) as well as on Swiss projects (ARE, 2004 a-d; Ott, 2005). The methods chosen were modified to incorporate the more detailed data available for the case study area. Figure 2 gives an overview over the main input data, the methodology and the basic assumptions for quantifying the external costs of transport in Saxony.

Input data

- Verhicle miles road, rail and inland waterway; number of movements in aviation
- Air pollutant emissions of transport and non-transport sources
- Immissions of air pollutants
- Transport surface
- Noise immissions, noise exposure
- Number and severity of accidents
- Number, structure and spatial distribution of population

Methods for monetising external costs of transport

	Components	Main assumptions
Accidents	Costs of reproduction Costs of resource losses Intangible costs Costs outside market	Modified method of the German Bundesanstalt für Straßenwesen (BASt) Intangible costs as willingness to pay: 1.5 million Euro per fatality
Noise	Willingness to pay	Target value: 55 dB(A) daytime, 45 dB(A) nighttime (SRU, 2005)
Air pollution	Health costs Building damages Crop losses Forest damages Intangible costs	Health costs: according to WHO; driving factor PM_{10} Building damages: direct and indirect method (Infras, 1992; ARE, 2004) Damage costs for crop losses and forest damages (Infras/IWW, 2000)
Climate change	Avoidance costs	Shadow value:135 €/t CO_2 according to Saxon and IPCC reduction aims, factor 2.5 for aviation
Nature and landscape	Combination from unsealing and compensation costs Willingsness to pay	Quantification of unsealing costs of surface sealed since 1950 as reference level Compensation costs for road and rail Willingness to pay for preserving nature and landscape (Infras/IWW, 2000)
Separation effects	Time losses for pedestrians	According to Infras/IWW (2000) following FGSV For all built-up areas of the noise register of Saxony
Land consumption	Space scarcity for bicycles	Costs for the construction of cycle tracks for streets with Average daily traffic volume > 3.000 vehicles per day
Up- and downstream processes	Life cycle analysis	Share of costs caused by operation

External costs for road, rail, aviation and inland waterway per municipality
Visualisation with geographic information systems

Figure 2: Input data and methodology for quantifying external costs of transport in Saxony.
Source: Gerike, 2006b.

The following general approaches to monetise the environmental impacts of transport were applied:

- Damage costs: Environmental damages that are caused by the transport sector are directly converted into monetary units. This approach is the most suitable way of assessing the costs of the environmental damages. However, it can only be applied if dose-response-functions are known.
- Willingness to pay (WTP)/hedonic price methodology: People are willing to pay for measures to improve the environment. This WTP can be regarded as the price for this environment. The first option to quantify this price is to ask people how much they are willing to pay for e.g. a certain amount of noise reduction (WTP). The second option is to investigate the differences between prices e.g. for dwellings with more and less noise exposure (hedonic price methodology). These

differences can be interpreted as lost money due to noise pollution. Both approaches indicate upper limits of external costs and are used here e.g. for quantifying noise and intangible costs.

- Prevention costs: This method quantifies the costs that are necessary to avoid certain environmental damages. To assess prevention costs it is necessary to set goals for environmental protection. These goals could be the result of a political process or scientific consensus. This method is often used for estimating climate costs.

Based on these general approaches specific methods to calculate the different external costs have been used. The following paragraph describes them in more detail (see also Figure 2):

Accident costs: The first component was the costs of reproduction including costs of medical treatment, professional rehabilitation and judicial costs. The second cost component, the costs of resource losses, included societal production losses causes by death or temporary inability to work. Net-production losses were quantified as product of losses of future working time and average per-capita income minus future consumption. The third and very sensitive cost component was intangible costs of health damages. These costs are quantified by using a "risk value" of 1.5 million Euros per fatality. This risk value was applied only for non-causers of accidents. The assumption was that the causers know about the risks related to their driving behaviour and have included it into their personal cost-benefit-calculation. The fourth cost component, the costs outside the market, included the production of goods and services that are not included into the national account. All those costs were reduced by motor vehicle third party liability insurance contributions in order to get the external accident costs.

Noise costs: The noise costs were calculated by using the cost rates developed by Infras/IWW (Infras/IWW, 2000, 2004). These cost rates were applied for a combined target value of 55 dB(A) for daytime and 45 dB(A) for night-time. This assumption is based on the recommendations of the German Advisory Council on the Environment.[2]

Air pollution costs: The air pollution costs are composed of health costs, building damages, costs due to crop losses and forest damages. Health costs are by far the dominant component. They were calculated based on epidemiological results of the WHO (Infras/IWW, 2000, 2004; WHO, 1999). As with accident costs, the intangible costs are a very sensitive component also for the calculation of air pollution costs. These costs were quantified in the same way than the accident costs.

Climate change costs: For quantifying the climate change costs a shadow price of 135 Euros per ton CO_2 was used. This shadow price is based on calculations on avoidance costs related to the goal of reducing transport CO_2-emissions by 50 percent until 2030 compared to 1990 (Infras/IWW, 2004; Becker, 2002). The chosen value is much higher than the shadow price of 20 Euros per ton CO_2, which would result from using the Kyoto-aims (Nash, 2003). The decision for the higher value was based on the assumption, that the shadow price should reflect the apparent deviations from long-term, scientific goals. The Kyoto protocol is an important step to achieve reductions of CO_2 emissions, but it is a political compromise and in the long term not sufficient. Even

[2] See SRU, 2005; using the target values of 65 dB(A) daytime / 55 dB(A) night-time recommended by the Environmental Noise Directive (RL 2002/49/EG) would lower the external noise costs by about 60 percent, see Gerike, 2004 for an analysis of sensitivity.

if all Kyoto aims will be met, there will be costs of climate change that future generations have to bear and that were caused by today's transport. These costs should be reflected by the external climate costs.

Nature and landscape: A biocentric approach was used to monetise the effects of transport infrastructure on nature and landscape: Starting from a predefined carrying capacity it was analysed to what degree the current transport system exceeds this carrying capacity and what costs would be necessary to keep it. The following components were included: unsealing and repair costs, costs of contamination of soil and water and a flat-rate value to consider further effects like visual constraints.

Separation effects: These effects were monetised by time losses due to waiting times and detours which pedestrians face at transport infrastructure in built-up areas. They are based on FGSV (1997) and Infras/IWW (2000).

Land consumption: These costs were quantified by the costs of scarcity based on FGSV (1997) and Infras/IWW (2000): "The legitimisation of these costs is based on a fairness principle: The road sector is leading to space scarcity in cities, which causes additional cost especially for non-motorised transport." (Infras/IWW, 2000, p. 48). Thus, the costs for bike lanes which have to be built at highly frequented roads were quantified.

Up- and downstream effects: The external costs of up- and downstream effects comprise all effects that are caused by activities for the transport sector that go beyond moving goods or passengers. Examples for those activities are the provision of energy, the production of vehicles and infrastructure. Based on Infras/IWW (2000) costs of air pollution and costs of climate change were included here as main components of up- and downstream effects.

The resulting costs of the environmental damages that transport causes comprise a certain degree of uncertainty. It arises from the different degree of accuracy of the input data as well as the methods for calculating the costs. Two strategies were applied to cope with this uncertainty. First, different methods were used in parallel to monetise one effect. In this way an interval with upper and lower limits was determined. Second, the precautionary principle was used: In case of any uncertainty concerning methodology and / or quality of input data lower limits were calculated. That means the results rather underestimate the "true" external costs of transport.

Input data was available at different spatial level of disaggregation depending on the type of external cost and transport mode. Data on traffic volumes, air pollutant emissions and energy use was available per link for a very detailed network for all transport modes. The road noise register of Saxony provided detailed data on noise and population. Data on air pollutant immission was taken from the Saxon immission register with a spatial disaggregation of 2.5 x 2.5 km^2. Information on number and severity of accidents was available on municipal level. Land-use data was obtained from official Saxon statistics.

All environmental effects of transport were included into the analysis as well as external costs of accidents.[3] The calculation was carried out at different levels of spatial disaggregation. Depending on the input data and the methodology the most disaggregated level possible was used. Finally, the results per cost component were converted to municipal level so that data on external costs of transport is available for all of the 522 municipalities of Saxony.

[3] See Becker, 2002 for the discussion of congestion and infrastructure costs.

All external costs of transport were calculated according to the inland principle: All environmental effects within Saxony were considered no matter whether they were caused by Saxons or by other people. Therefore, only the LTO-cycle (Landing-Take-Off) was taken into consideration for aviation up to 915 m (3000 ft) (Gerike, 2000).

The methodology described above was applied to determine the status quo in Saxony and to forecast the external costs for the policy scenario as well as the BAU-scenario. For both forecast scenarios the following assumptions were made:

- Only real changes were calculated: No rate of price increase was included. Thus, the changes of external costs predicted only reflect the changes of real environmental effects. Consequently, the risk value and the shadow price for climate costs are not extrapolated by any interest rate.
- Accidents: The estimated number of unreported accidents was taken from the status quo based on the assumption that no relevant changes in regulation will come into effect. Furthermore, the share of causers compared to all casualties is an important input parameter. It differs between the vehicle categories: For accidents with two-wheeled vehicles involved, almost all injuries are causer (80% with motor bikes, 84% to 90% for mopeds). This share decreases to about 18 percent for duty vehicles and 33 percent for private cars (Gerike, 2006b). In the BAU-scenario it is assumed that the transport volume for two-wheeled vehicles and duty vehicles increases, while it decreases for private cars compared to the status quo. Since these trends are contrary to each other and the share of causers was stable in the years analysed for the status quo, the status quo share of causers to non-causers was applied to the BAU-scenario too.
- Air pollution, noise: For the air pollutant emissions it could be referred to the DAVUS-project and to the road noise register of Saxony (Scharfe, 2004). The immissions were predicted from the status quo based on the development of air pollutant emissions as well as of climatic conditions.[4]

4. External costs of transport in Saxony - the status quo

Table 1 shows the external costs of transport per cost component for all transport modes in the year 2002. This is the most recent year calculated in the status quo. The dominant transport mode is road transport which causes about 95 percent of all external costs of transport. Rail transport is responsible for about 4 percent of total external costs. Waterborne and aviation together cover 1 percent.

Table 2 gives an overview over the shares of the different vehicle categories within road transport. Here, the car is dominant causing 64 percent of all external costs. The most important cost component of cars is the accident component. That is, because of the risk value used to quantify intangible costs.[5] The risk value also influences the external health costs caused by air pollution as further important cost component. The climate costs are very sensitive to the shadow prices used. These costs are also very

[4] See LfUG, 2005 for a discussion of climate change problems for Saxony.

[5] See section 3 for the methodology used for quantifying intangible costs. See Gerike, 2000 for a sensitivity analysis for all cost components.

high since a shadow price of 135 Euros per ton CO_2 was taken as basis. The up- and downstream costs depend mainly on external costs of air pollution and climate change.

Table 1: External costs of transport modes in 2002.

[m Euros]	*Road*	*Rail*	*Aviation*	*Waterborne*	*Total*
Accidents	2,185	0	1	0	2,186
Air pollution	1,386	63	0	8	1,457
Climate change	1,061	43	14	5	1,123
Up- and downstream processes	547	42	2	3	594
Noise	406	102	2	n.c.	510
Nature and landscape	197	0	0	n.c.	197
Land consumption	97	n.c.	n.c.	n.c.	97
Separation effects	1	0	n.c.	n.c.	1
Total	5,880	250	19	16	6,165

Note: N.c. = not calculated.
Source: Gerike, 2006b.

Table 2: External costs of different vehicle categories in road transport in 2002.

[m Euros]	*Car*	*LDV/HDV*	*MC*	*Bus*	*Total*
Accidents	1,879	170	123	13	2,185
Air pollution	556	770	0	60	1,386
Climate change	659	370	9	23	1,061
Up- and downstream processes	324	208	3	12	547
Noise	125	260	16	5	406
Nature and landscape	133	60	2	2	197
Land consumption	78	17	2	1	98
Separation effects	1	0	0	0	1
Total	3,755	1,855	155	116	5,881

Note: LDV = Light Duty Vehicle; HDV = Heavy Duty Vehicle; MC = Motorcycle
Source: Gerike, 2006b.

Figure 3 shows the spatial distribution of external costs for all transport modes. Here the concentration of external costs in the main cities becomes apparent: The 10 biggest municipalities, where 37 percent of inhabitants live, cause 31 percent of total external costs. The three biggest cities Dresden, Leipzig and Chemnitz alone, covering 5 percent of the whole area of Saxony and 28 percent of inhabitants, generate a share of 24 percent of external costs of transport (Gerike, 2005).

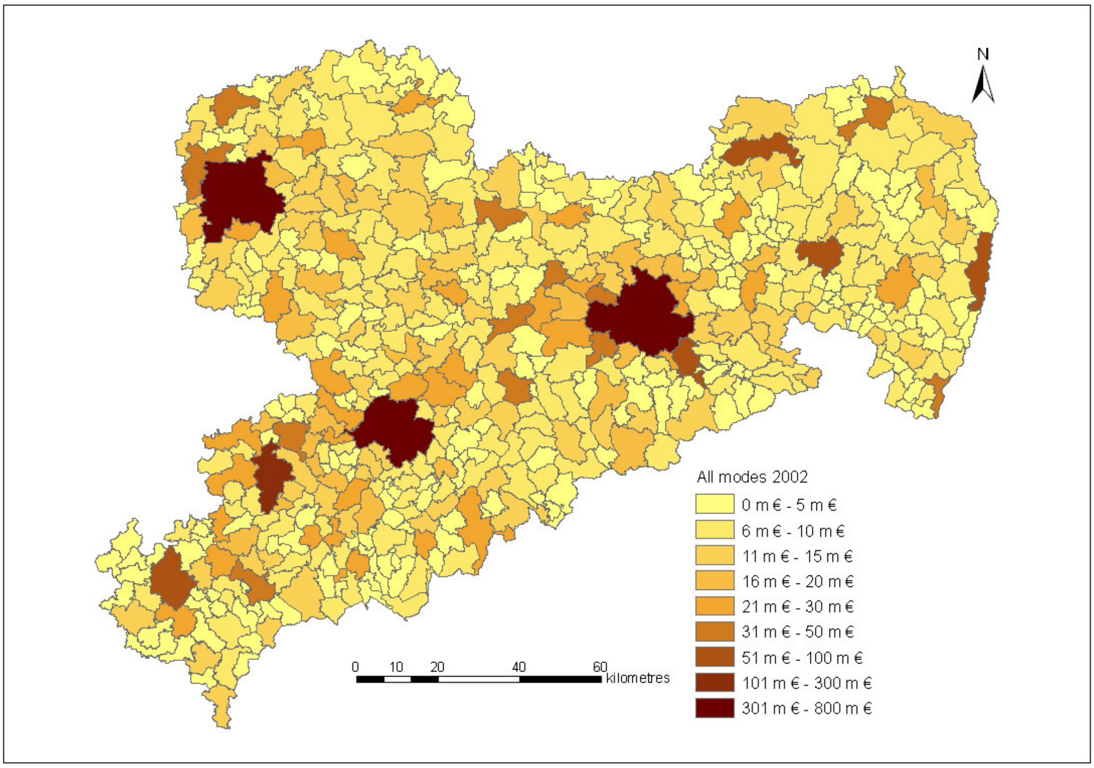

Figure 3: Total external costs of all transport modes in Saxony in 2002.
Source: Gerike, 2006b.

5. The policy package

The development of the policy package was guided by the following considerations (see Gerike, 2004, 2006b):

- The results so far have shown that external costs and thus the environmental effects in transport consist of several components which are each characterised by different qualities: Noise exposure depends for instance mainly on traffic volumes, road surface and technology of the vehicles, such as the engine performance. Number and severity of accidents, however, depend on driving behaviour and on road design. Because of these varying characteristics it is not possible to choose one single measure that effectively reduces all environmental effects. Different measures that target the different environmental impacts of transport are needed.
- Pricing and non-pricing measures differ in their degree of effectiveness and acceptability. Pricing measures are very effective for reducing environmental effects, but they are lacking public and political acceptability. Non-pricing measures are on the other hand well accepted, but not as effective. By combining pricing and non-pricing measures in a so-called package approach a reasonable degree of acceptability even for pricing measures can be achieved (Jones, 2001; Schade & Schlag, 2000; Goodwin, 1989).

- The results of section 4 and the knowledge about the characteristics of the external costs of transport in Saxony to date enabled us to identify the most relevant components and areas in order to set the priorities within the policy package accordingly.
- Furthermore, mainly measures were chosen which Saxony is responsible for the implementation. However, this requirement needed to be relaxed somewhat, because the legal responsibility to implement some of the most effective measures is assigned to the Federal or even European level. Thus, a compromise had to be made between the aim of effectiveness and the possible implementation by the Free State of Saxony.
- Finally, when specifying each measure current policy developments in Saxony were taken into consideration in order to facilitate the implementation of the policy package by using current and possible future windows of opportunity.

These considerations let us conclude, that a package of policy measures is necessary which focuses on different environmental effects and includes pricing as well as non-pricing measures. The aim was twofold. On the one hand the intention was to include the main effects that cause the highest amount of external costs (air pollution and climate costs, accident and noise costs). On the other hand the spatial distribution of external costs of transport in Saxony was considered. Here, a significant concentration in urban areas became apparent (see section 4).

Figure 4 describes the measures chosen and their specification for the modelling exercise and the acceptability study. Since the package became quite comprehensive, it was decided to divide it into four parts to keep it clear and manageable. The four parts of the package also represent the main foci of the policy package resulting from the Saxon conditions: urban transport, land consumption, climate change and safety.

The first part of the policy package focuses on urban transport. It contains measures which should be mainly implemented in the main Saxon cities (Chemnitz, Dresden, Leipzig). The focus was set on air pollution and noise that are above average in these urban areas. Furthermore, the measures are aimed at reducing traffic volume in the inner cities in general in order to achieve an overall reduction of environmental effects of transport. The two pricing measures in this part of the package are urban road pricing and parking management. The level of charge for urban road pricing was determined to correspond with a single ticket for public transport. Parking management is explicitly proposed for both, the city centre as well as shopping centres outside the city. That is, in order to prevent the distortion of the competition between the retail sector in the city centres and the shopping centres outside. Since a number of shopping centres outside the cities exist, this specification seems necessary not only to prevent negative side-effects but also to get support from the local business community. Thus, the level of both pricing measures was explicitly not based on marginal external costs but was chosen pragmatically. The aim was to move towards the polluter-pays-principle while simultaneously keeping the pricing measures comprehensible for the public.

The external costs of land consumption do not belong to the main costs mainly because of the methodological difficulties in monetising changes in soil and water quality caused by transport. However, this is a serious long-term problem from an environmental point of view that attracts increasingly attention especially in the discussion on sustainable development. Therefore, the problem of land consumption should be included in any policy package reducing the environmental impacts of transport. Furthermore, the continuing migration of people to other parts of Germany in combination with the demographic change in Saxony will lead to declining tax revenues in the future. This makes investments in infrastructure and even the maintenance of the existing transport infrastructure an expensive endeavour (Ahrens, 2005). By linking new construction projects to existing public transport connections, developments in new areas will become less attractive which reduces land consumption considerably. Furthermore, if public transport access needs to be in place prior construction, the costs of building new transport infrastructure become part of the overall land development costs. That again makes areas that are closer to the existing public transport network more attractive.

The third part of the policy package deals with climate change. It is regarded as key to the effectiveness of the policy package as a whole. A reduction of external costs in that area will influence all other environmental effects in a positive direction and is therefore vital for environmental protection. Thus, the measures belonging to this part of the package have been included despite the fact that they mainly do not fall into the legal responsibility of Saxony. However, on the European and Federal level there is considerable progress in the discussion on climate change and the transport sector. Recently, the European ministers of environment decided to commit to reducing greenhouse gas emissions by 30 percent until 2020 in the frame of an international agreement on climate protection (compared to 1990). The EU intends to reduce their emissions at least by 20 percent until 2020 (compared to 1990) until a new agreement will be arranged and independent of their position in international negotiations. The German government announced even more ambitious targets. Thus it seemed reasonable to include these policy measures, even though they cannot be implemented by the Saxon authorities themselves.

The last part of the package was devoted to traffic safety. That is, because first accidents cause significant external costs (see section 4). Second, in previous years Saxony has invested considerable resources in improving traffic safety. For example, Saxony participated in a pilot project introducing the learner driver's license, which allows teenagers to drive already at the age of 17 (instead of 18), provided that they are accompanied by a licensed driver. Therefore, the positive political climate in Saxony may be used as window of opportunity to facilitate the implementation of these policy measures.

Policy measures	*Specification in the policy scenario*
Measures focusing on urban transport	
1: Urban road pricing	City centre cordon: flat rate for entry of 1.70 €/day
2: Parking management	In city centres as well as shopping centres outside cities: 1.00 €/hour
3: Pedestrian zones	Extension of existing pedestrian zones
4: Higher environmental standards in public transport	EEV for all public transport vehicles
5: Promotion of cycling	Extension of the cycle network, bicycle parking facilities
6: Promotion of car sharing	Centrally located parking facilities, co-operation of car sharing operators with public transport
7: Access restrictions	Access restrictions for high emission vehicles in sensitive areas such as city centres or nature reserves
Measures focusing on land consumption	
8: Sustainable transport planning	Public transport access must be in place prior new developments
Measures focusing on climate change	
9: CO_2-tax	To cover climate damages an additional tax on petrol: + 0.32 €/litre and diesel: + 0.36 €/litre will be levied
10: Promotion of fuel saving driving behaviour	Driver's education and training programmes emphasis and practice fuel saving driving behaviour
11: Promotion of alternative fuels	Biodiesel will be subsidised by lower prices, more petrol stations and research programmes
Measures focusing on safety	
12: Risk differentiation of driver's third party liability insurance	Bonus-Malus system according to accident risk
13: Speed reductions	Motorways: 120 km/hour , urban areas: 30 km/hour
14: Reform of driver's education	Pilot projects of learner driver's licenses, which allow a person to drive provided they are accompanied by a licensed driver
15: Higher safety standards	Legal alcohol limit for driving reduced to 0.00‰.

Figure 4: Package of policy measures.
Source: Gerike, 2006b.
Note: EEV = Enhanced environmentally friendly Vehicle (category used in European emission standards)

6. Effectiveness of the policy scenario

In this section the results of the modelling exercise analysing the effectiveness of the policy scenario are presented. The impacts of the policy scenario are compared to a BAU-scenario. The BAU-scenario was based on the assumption that there will be no significant changes in transport policy within the time span of modelling. The policy and BAU-scenario were modelled for the year 2020. This time span has been chosen because it is far enough into the future to capture not only short time but also long-time effects. On the other hand, the year 2020 is close enough to the status quo so that reliable results could be obtained by taking current transport trends into consideration. Furthermore, the project DAVUS (Scharfe, 2004) which was an important data base for

Vehicle Kilometres Travelled (VKT) and air pollutant emissions provided detailed data for the year 2020.

First, the expected development of key input data is described since these changes considerably influence the development of external costs. Second, the development of external costs itself will be presented. Table 3 shows the Vehicle Kilometres Travelled (VKT) in the policy scenario as well as in the BAU-scenario. Car traffic performance in the policy scenario is about 12 percent lower compared to the BAU-scenario. Bus traffic performance is significantly higher, about 10 percent.

Table 3: Differences in vehicle kilometres travelled in the policy scenario compared to the BAU-scenario.

[m vkm]	*2020 BAU*	*2020 Policy*	*Difference in %*
Car	26,047	22,843	-12%
MC	805	792	-2%
Bus	198	218	+10%
LDV/HDV	6,428	6,114	-5%

Source: Gerike, 2006b.

Figure 5 describes the results for the air pollutant emission. The total emissions are significantly lower in the policy scenario compared to the BAU-scenario. This holds true for the CO_2-emmissions, the PM10-emmissons as well as the NOx-emissions. The reasons for these reductions are a changed fleet mix and driving patterns as a consequence of the policy measures. However, the development of the emissions is partly compensated by the further increase in the traffic performance (see section 2).

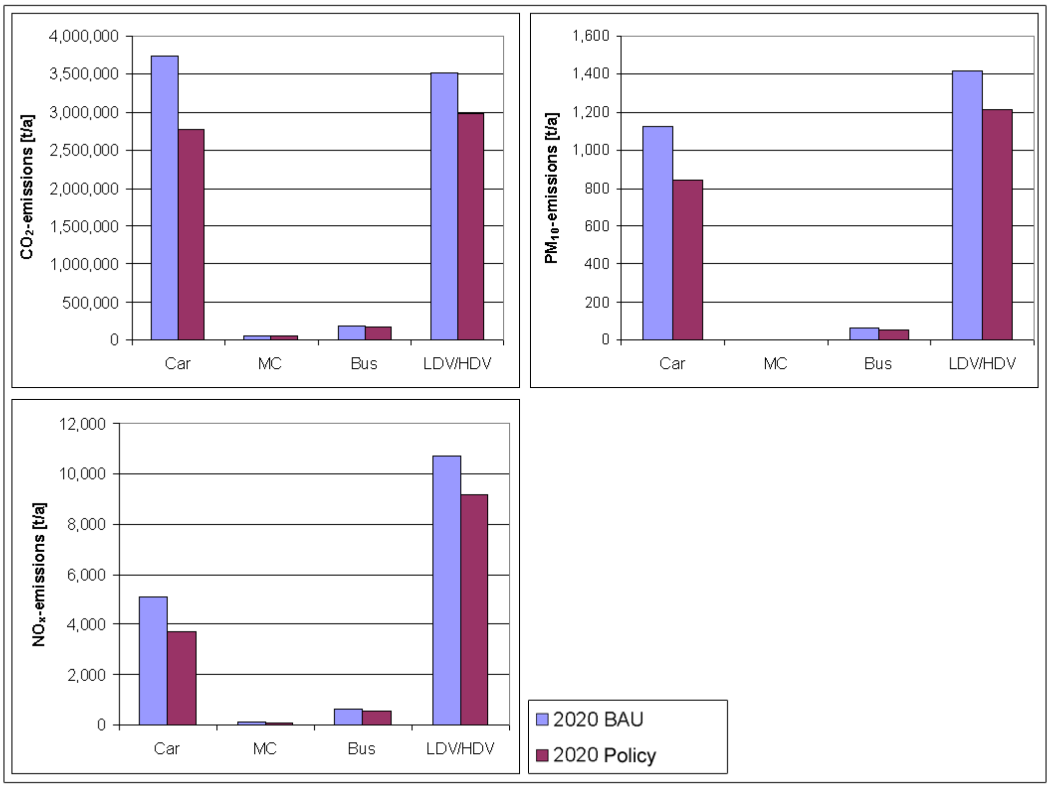

Figure 5: Reduction of air pollutant emission in the policy scenario compared to the BAU-scenario.
Source: Gerike, 2006b.

The policy scenario furthermore results in reductions of accident rates by 23 percent compared to the BAU-scenario. That means that in the policy scenario there are 23 percent fewer injuries per vehicle mile travelled than in the BAU-scenario. Figure 6 shows how this affects the total accident figures. The number of injuries decreases by 31 percent. Hence, the reduction of accident rates is facilitated by decreasing transport performance achieved through the policy measures.

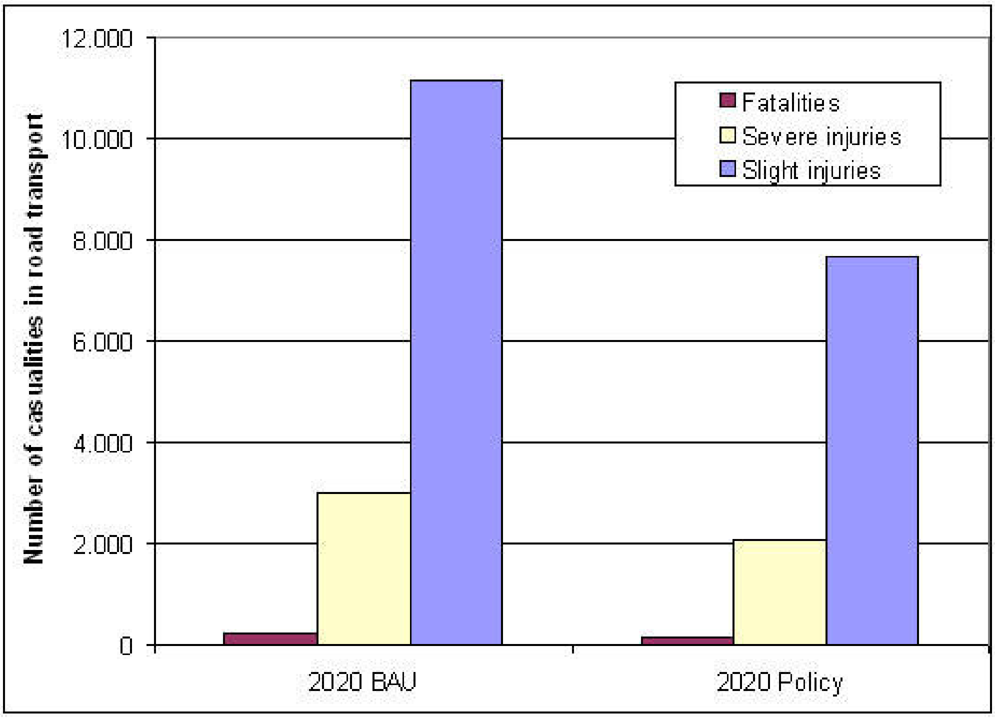

Figure 6: Number of causalities in road transport.
Source: Gerike, 2006b.

Table 4 shows the external costs of road transport predicted for the year 2020 for the BAU-scenario and the policy scenario. The total external costs of road transport amount to nearly 4,000 million Euros in the policy scenario, which corresponds to 82 percent of the total external costs in the BAU-scenario. That is a reduction of 18 percent. The strongest reduction is observed for the accident costs that decline to 69 percent in the policy scenario. This effect is exclusively due to the lower number of injures in the policy scenario (cf. Figure 5). The noise costs decline to 94 percent due to decrease in traffic performance in some of the different vehicle categories. The costs of air pollution and climate change are reduced because of the reductions of air pollutant emissions and energy use. It is expected that the policy measures achieve improvements in the specific environmental performance per vehicle kilometre as well as in the total environmental impacts. The external costs of nature and landscape, land consumption and separation effects remain stable because it is assumed that the transport infrastructure remains unaffected by the policy package. Despite the fact that no changes were assumed for these effects, they are included in Table 4 and Figure 7 for making the absolute numbers comparable to the status quo presented in section 4.6.

---

[6] Spatial effects were treated separately (Spiekermann, 2005).

Looking at the shares of the cost components the share of accidental costs declines from 26 percent in the BAU-scenario to 22 percent in the policy scenario. The share of all other components remains stable respectively goes up even if the absolute numbers decline. The share of air pollution costs for instance goes up from 27 percent to 30 percent, the share of noise costs increases from 7 percent to 9 percent.

Table 4: External costs of road transport: BAU- and policy scenario (in prices of 2000).

	2020 BAU	*2020 Policy*	*Difference in %*
Accidents	1192	819	-31%
Noise	337	318	-6%
Air pollution	1,235	1,093	-12%
Climate change	1,015	806	-21%
Nature and landscape	149	149	-
Usage of space	94	94	-
Separation effects	1	1	-
Up- and downstream processes	503	414	-18%
Total	4,528	3,694	-18%

Source: Gerike, 2006b.

Figure 7 gives an overview over the distribution of costs components within the road sector as dominant transport mode in the two scenarios. The strongest reduction of externals costs is achieved within cars. The external costs decline from 2,592 million Euros to 1,976 million Euros in the policy scenario. The main reason for this decrease is again the declining accident figures.

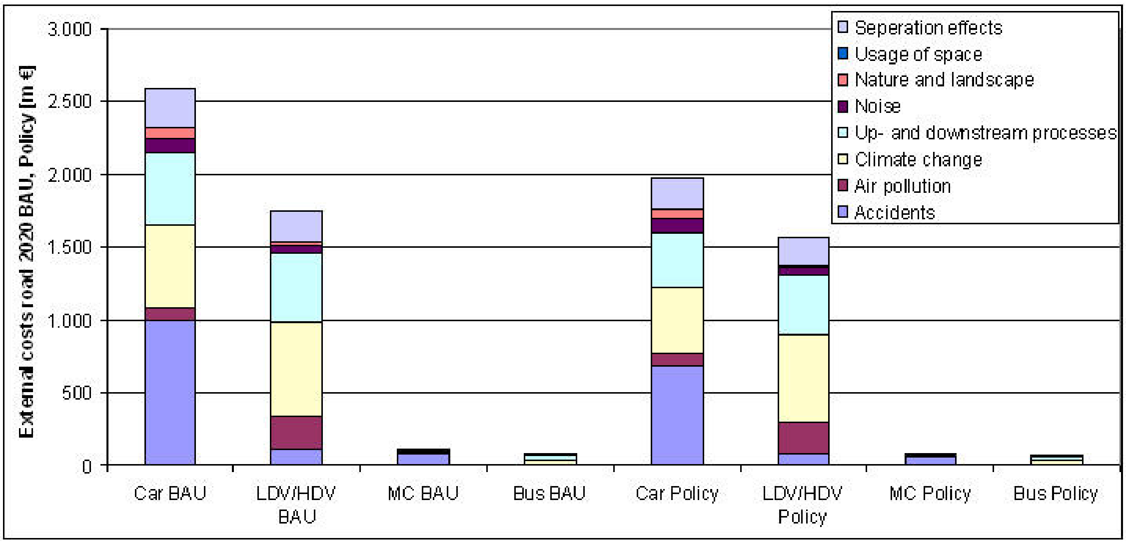

Figure 7: Total external costs of road transport in 2020: BAU-scenario and policy scenario.
Source: Gerike, 2006b.
Note: Car BAU = Car BAU-scenario, Car Intern. = Car Policy scenario

7. Acceptability of the policy package

A political and public acceptability survey was conducted to assess the acceptability of the policy package. A semi-standardised interview with Saxon citizens as well as politicians and decision-makers was designed and conducted. The policy package was presented to the participants using the card sorting technique. That means, the specification of each proposed policy measure was printed on a 15 cm x 21 cm card. Theses cards and the specifications of the policy measures respectively were presented to the participants one by one with no reference to the four parts of the package (see Figure 4). After the presentation participants were asked about their assessment of this particular policy measure. If participants did not understand the meaning of a policy measure further explanations were given prior to the assessment questions. These explanations were determined beforehand and in this way standardised for all participants. Each interview lasted approximately 60 minutes.

The citizen sample consisted of 40 participants, 19 male and 21 female participants. The average age was 42 years (SD = 16.45 years). 57.5 percent of the participants were living in Saxon cities and 42.5 percent were living in rural areas. 92.5 percent of the participants had a driving licence and 77.5 percent owned a private car. Those 77.5 percent also used their private cars as main mode of travel, only 22.5 percent used public transport.

The sample of politicians and decision-makers consisted of 15 participants, 13 male and 2 female participants. The average age was 46 years (SD = 7.29 years). All of them were working in the transport sector in Saxony at the time of the interview and therefore chosen as experts. However, this sample just as the citizen sample is not representative for the population of Saxon citizens and decision-makers. 3 participants belonged to the Federal state level, 1 participant to the district level, 9 participants to local authorities and 5 participants to relevant companies and associations. Every participant possessed a driver's licence. 53 percent of participants used their private car as the main travel mode followed by 40 percent using public transport.

After the presentation of each policy measure participants were asked to evaluate three aspects: the acceptability, the perceived effectiveness and the knowledge of each measure on a 4-point scale from 1 = not at all known/effective/acceptable to 4 = most well known/effective/acceptable. The politicians and decision makers were not asked about their knowledge. It was assumed that as experts in the transport sector they are familiar with these measures. Finally, the acceptability of the whole policy scenario was assessed using the 4-point scale again.

In contrast to the evaluation of the effectiveness of the policy scenario (see section 6) the acceptability was not only assessed for the whole scenario but also for each policy measure separately. Only after participants evaluated each policy measure they were asked about their acceptability of the whole scenario. The reason for this procedure was twofold. First, the composition of the policy package was based on a number of considerations (see section 5). For example, it was assumed that pricing measures are least accepted whereas non-pricing measures are well accepted. These considerations are mainly based on the results of international studies and have not been validated in the Saxon context. Thus, the results of the single measures were used to verify the considerations of the package composition. The second reason was to give participants enough time to get familiar with each policy measure before they are asked to evaluate the whole policy scenario.

The results of the public acceptability, the knowledge and the perceived effectiveness of each policy measure are presented in Table 5. In general most policy measures are rather unknown. The most well-known measures were the learner driver's license, the legal alcohol limit of 0.00‰ and car sharing. The least known measures were the reform of driver's third party liability insurance, parking management and the CO_2-tax. According to the participants their knowledge about the policy measures results mainly from the political discussions in the media. Against this background it is not surprising that for example the new learner driver's license is a rather well-known measure whereas the more established parking management did not receive a high knowledge score. At the time of the interviews a pilot project concerning the new learner driver's license has just started and pictured in the media.

The effectiveness of the measures is assessed somewhat more positive. On average 75 percent of the policy measures were regarded as effective or rather effective. The legal alcohol limit of 0.00‰ and the access restrictions in sensitive areas are assessed as most effective whereas the learner driver's license, the parking management and the promotion of alternative fuels were regarded as least effective measures. Hence, the theoretical assumption that more well-known measures are also regarded as more effective does not apply to all cases (Schade & Schlag, 2000).

The acceptability of the policy measures was quite mixed. As expected the pricing measures such as urban road pricing or the CO_2-tax were rather unacceptable. In contrast non-pricing measures such as the promotion of cycling and car sharing were more acceptable to the public. The promotion of cycling and fuel saving driving behaviour were regarded as most acceptable. Least acceptable were parking management and the CO_2-tax as well as the learner's driving licence.

Table 5: Public acceptability of the policy package (1=not at all to 4=most, mean values).

Policy measures	*Knowledge*	*Perceived Effectiveness*	*Acceptability*
Measures focusing on urban transport			
1: Urban road pricing	1.75	2.90	2.30
2: Parking management	**1.23**	**2.30**	**1.70**
3: Pedestrian zones	2.48	2.87	3.47
4: Higher environmental standards in public transport	2.00	3.22	3.35
5: Promotion of cycling	2.28	2.82	3.65
6: Promotion of car sharing	2.70	2.65	3.15
7: Access restrictions	2.35	3.35	3.45
Measures focusing on land consumption			
8: Sustainable transport planning	1.65	2.50	2.90
Measures focusing on climate change			
9: CO_2- tax	**1.40**	2.82	**1.60**
10: Promotion of fuel saving driving behaviour	2.10	3.10	3.57
11: Promotion of alternative fuels	2.05	**2.32**	2.25
Measures focusing on safety			
12: Risk differentiation of driver's third party liability insurance	**1.13**	3.02	3.45
13: Speed reductions	2.33	3.00	2.27
14: Reform of driver's education	2.95	**1.90**	**1.97**
15: Higher safety standards	3.53	3.50	3.40

Note: the highest mean values are indicated by white/grew numbers, the lowest mean values by black bold numbers

The aim of composing a package of policy measures was to achieve a reasonable degree of acceptability especially for the pricing measures. Thus, participants were asked to evaluate the acceptability of the whole policy scenario. With a mean value of 2.12 the acceptability of the policy scenario lies within the range of the lowest mean values (2: Parking management; 9: CO_2-tax) and the highest mean values of the single measures (5, 10: Promotion of cycling and fuel saving driving behaviour). Overall 37.5 percent of the participants stated that they agree at least somewhat with the policy scenario. Compared to the figures of 10 percent to 20 percent that are reported for pricing measures as single measure this can be regarded as a substantial improvement (see Schade & Schlag, 2000; Jones 2001; Lyons, Dudley, Slater & Parkhurst, 2004). That means that pricing measures received indeed a higher acceptability score within the policy package than as single measures. Only urban road pricing received a somewhat higher mean value as single measure.

The results for the political acceptability and the perceived effectiveness of politicians and decision-makers are presented in Table 6. Similar to the public the decision-makers assessed the effectiveness of the policy measures rather positive. All measures were assessed as at least rather effective with mean values higher 2.50. The only exemption is the learner driver's license which is regarded as rather ineffective. The positive assessment of the effectiveness of the policy measures by the experts can be regarded as a tentative validation of the modelling exercise results which demonstrated that the policy package significantly reduces external costs in transport in Saxony.

For the politicians pricing measures were less acceptable than non-pricing measures as well. However, the level of support for pricing measures was higher compared to the citizens. Furthermore, the learner driver's license that was already assessed as not effective was rather unacceptable. Most acceptable to the politicians were the promotion of cycling and fuel saving driving behaviour and the reduction of the legal alcohol limit to 0.00‰.

Table 6: Political acceptability of the policy package (1=not at all to 4=most; mean values).

Policy measures	*Perceived Effectiveness*	*Acceptability*
Measures focusing on urban transport		
1: Urban road pricing	2.73	**2.47**
2: Parking management	2.60	2.60
3: Pedestrian zones	2.93	2.80
4: Higher environmental standards in public transport	2.73	3.13
5: Promotion of cycling	3.47	3.80
6: Promotion of car sharing	2.73	3.40
7: Access restrictions	3.29	3.36
Measures focusing on land consumption		
8: Sustainable transport planning	3.13	3.27
Measures focusing on climate change		
9: CO_2- tax	2.60	2.67
10: Promotion of fuel saving driving behaviour	2.67	3.53
11: Promotion of alternative fuels	2.73	2.73
Measures focusing on safety		
12: Risk differentiation of driver's third party liability insurance	3.07	3.33
13: Speed reductions	3.20	2.73
14: Reform of driver's education	**2.07**	**2.00**
15: Higher safety standards	3.27	3.60

Note: the highest mean values are indicated by white/grew numbers, the lowest mean values by black bold numbers

With a mean value of 2.67 the acceptability of the entire policy scenario lies within the range of the lowest mean values and the highest mean values of the single measures for the politicians and decision-makers as well (1: Urban road pricing vs. 5: Promotion of cycling). Overall 66.7 percent of this sample evaluated the entire policy scenario as suitable for reducing external costs of transport in Saxony. Even thought politicians accepted pricing measures as single measure to a higher degree compared to the citizens they also supported them more as part of a policy package.

Comparing public and political acceptability it seems that there are only minor differences. Both groups regarded the promotion of cycling and fuel saving driving behaviour as the most acceptable measures. Furthermore, the reduction of the legal alcohol limit of 0.00‰ and the access restrictions received high acceptability scores. The smallest mean difference between both groups was observed for the learner driver's license. Both groups did not accept this measure. They shared the view that teenagers are not mature and careful enough at that age. Furthermore, they do not agree with the imitation of American examples, with which this kind of driver's education is associated. Statistically significant differences between public and political acceptability were found for the CO_2-tax and the parking management which were accepted to a higher degree by the politicians. The reverse holds true for the access restrictions which were accepted to a higher degree by the public (Mann Whitney U-Test, $p < 0.05$).

Figure 8 compares the public acceptability with the public acceptability as it is perceived by politicians and decision-makers. The results show that the public acceptability is mostly underestimated. This replicates the results of a similar study by Schade and Schlag (2000). The closest correspondence was found for the CO_2-tax, the promotion of car sharing and the promotion of alternative fuels. The biggest discrepancy was found for urban road pricing, pedestrian zones and the risk differentiation of driver's third party liability insurance. The public acceptability of these measures was far higher than anticipated by decision-makers. And even though this acceptability study comprised only a small and not representative sample it suggests that not only the public acceptability of pricing measures but restrictive measures in general is underestimated by politicians and decision-makers. That may explain why the overall positive political acceptability of the proposed policy measures has not been translated into political actions so far.

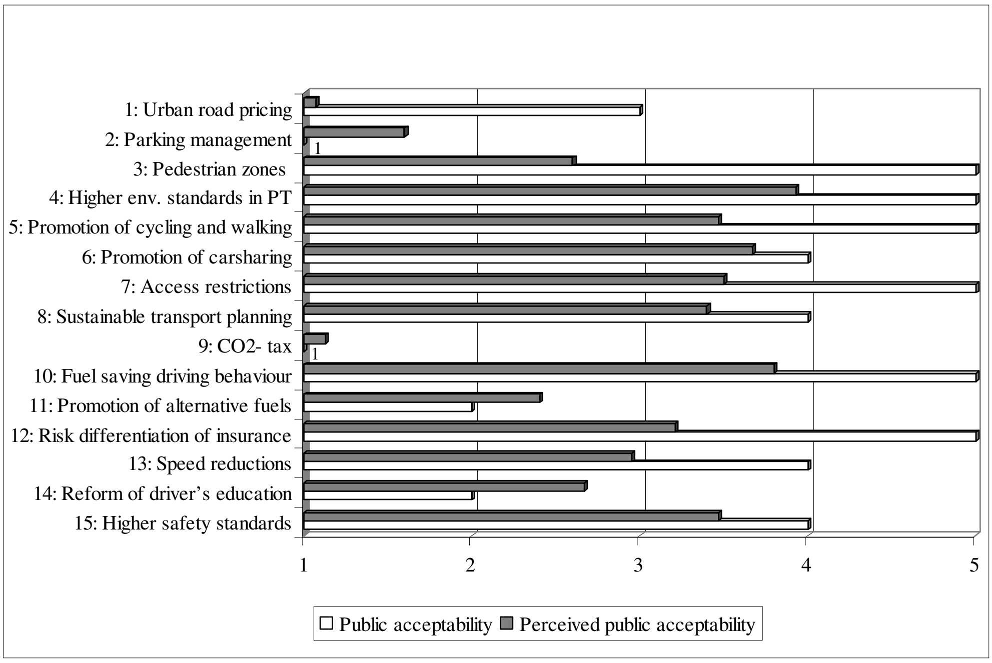

Figure 8: Comparison of public acceptability and the assumed public acceptability by politicians and decision-makers (mean values).

Note: Perceived public acceptability was measures on a percentage scale from 1 = 0-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61-80% to 5 = 81-100%. The relative frequency of the public acceptability has been transformed into the percentage scale for comparison.

8. Summary and Conclusions

There is scientific consensus, that external costs cause inefficiencies in the transport sector. Their reduction is a vital condition for making transport more efficient and environmentally friendly. The situation is clear theoretically. However, political activities to move forward with this approach have only been undertaken tentatively.

Politicians are reluctant to increase the costs for transport because they fear resistance from the public and the business community. Pricing measures, which are very effective for reducing the environmental impacts of transport, lack public and political acceptability. Non-pricing measures on the other hand are well accepted, but not as effective. The combination of pricing and non-pricing measures in a so-called package approach is regarded as a promising solution to this dilemma. An increase in the costs of transport will probably always remain a controversial issue, but a policy package may gain sufficient public support to move forward with the implementation of the polluter-pays-principle reducing the environmental impacts of transport.

This paper presents such a package solution for the Free State of Saxony. Based on the current situation of external costs of transport in Saxony (the status quo) a package of policy measures was developed. The impact of this policy scenario was assessed and compared with a Business-As-Usual-scenario (BAU-scenario). Furthermore, the public and political acceptability of this policy package was analysed.

The main conclusions of this research are:

- The decline in population due to the demographic change does not solve the environmental problems of transport in Saxony. Even though a decrease by 14 percent is predicted from 2000 to 2020, road transport volumes will remain stable with car volumes decreasing by only 4 percent and freight transport even increasing by 15 percent. Therefore, political actions are necessary to significantly reduce the environmental impacts and thus the external costs of transport.
- The modelling results show that a package approach of pricing and non-pricing measures is effective for reducing the environmental impacts in transport. The policy package reduces the external costs by 18 percent compared to the BAU-scenario.
- The interviews revealed that citizens as well as politicians assessed the policy package as rather effective for solving the environmental problems of transport. As expected the acceptability of the single policy measures was mixed. Pricing measures such as urban road pricing or the CO_2-tax were rather unacceptable. Non-pricing measures such as the promotion of cycling and car sharing were more acceptable. But overall almost 40 percent of the citizens supported the entire policy package. This is a substantial improvement of the acceptability of pricing measures. Presented as single measures they typically gain public support of only 10 percent to 20 percent. However, the level of public acceptability especially of restrictive and pricing measures was clearly underestimated by politicians and decision-makers. That may explain why they hesitate to put forward effective pricing measures in the transport sector.

This paper has demonstrated that it is possible to design a package of policy measures for reducing environmental impacts in transport that is effective as well as acceptable on a local level. Even though it is certainly not realistic to assume that this package will fully be implemented in a short period of time, it can serve as a guideline for a sustainable transport policy in Saxony in a long-term perspective. Furthermore, the process of designing such a policy package described here may serve as an example for other cities or regions how to initiate a process of reducing external costs of transport.

Acknowledgements

The authors thank Prof. Becker and the referees for their comments and advices. The research programme was funded by the Saxon Department for Environment and Geology (LfUG), Dresden, Germany. Financial support is gratefully acknowledged.

References

Ahrens, G.-A. (2005) Demographic changes - consequences for the transportation sector. *Journal for Public Health*, No. 1: 16-21.

Becker, U.; Gerike, R.; Rau, A.; Zimmermann, F. (2002) *Determination of external costs of transport for Saxony – main study.* Study on behalf of Saxon Department for Environment and Geology, Final report, Dresden, http://hsss.slub-dresden.de/deds-access/hsss.urlmapping.MappingServlet?id=1173280083359-8184 – in German.

Bickel, P.; Friedrich, R. (Ed.) (2005) *ExternE. Externalities of Energy*. Methodology 2005 Update, Stuttgart, http://www.externe.info/.

ECMT (2004) *Assessment and Decision Making for Sustainable Transport.* European Conference of Ministers of Transportation, Organization of Economic Coordination and Development (www.oecd.org)

European Commission (2006) *Keep Europe Moving - Mid-term review of the 2001 Transport White Paper*. Brussels, http://ec.europa.eu/transport/transport_policy_review/index_en.htm.

Federal Office for Spatial Development (ARE) (2006) *External costs of road and rail transport 2000*. Bern. – in German.

Federal Office for Spatial Development (ARE) (Ed.) (2004a) *External costs of transport in the field of nature and landscape – monetising fragmentation*. Bern. – in German.

Federal Office for Spatial Development (ARE) (Ed.) (2004b) *External health costs caused by transport-related air pollution in Switzerland – Update for the year 2000*. Bern. – in German.

Federal Office for Spatial Development (ARE) (Ed.) (2004c) *External noise costs of road and rail transport in Switzerland – Update for the year 2000.* Bern. – in German.

Federal Office for Spatial Development (ARE) (Ed.) (2004d) *Damages to buildings caused by transport – Update of external costs fort the year 2000*. Bern. – in German.

Federal Highway Research Institute (BASt) (2006) *Counting foreign car traffic on federal motorways and European roads 2003*. BASt-report V 141, http://www.bast.de/nn_42742/DE/Publikationen/Fachliche/Berichte/unterreihe-v/2006-2004/v141.html – in German.

Road and Transportation Research Association (FGSV) (1997) *Recommendations for economic feasibility studies on roads* (EWS), Update of RAS-W 86, FGSV-No. 132, Köln – in German.

Gerike, R. (2007) *How to make sustainable transportation a reality – the development of three constitutive task fields for transportation*. München: Oekom.

Gerike, R.; Seidel, T.; Becker, U.; Richter, F.; Schmidt, W. (2006b) *Consequences of an internalisation package for Transport in Saxony.* Study on behalf of Saxon Department for Environment and Geology, Final report, Dresden. – in German.

Gerike, R.; Seidel, T. (2005) Internalisation of external effects in transportation – chance or illusion? *Verkehrsforschung-online*, *2,* 1-20, http://www.verkehrsforschung-online.de/ – in German.

Gerike, R. (2004) *Updating external costs of transport for Saxony*. Study on behalf of Saxon Department for Environment and Geology, Dresden. – in German.

Gerike, R.; Becker, U. (2000) *Determination of external costs of transport for Saxony – preliminary study*. Study on behalf of the Saxon Department for Environment and Geology, Final report and manual of arguments, Dresden. – in German.

Goodwin, P. (1989) The "Rule of the Three": a possible solution to the political problem of competing objectives for road pricing. *Traffic Engineering + Control* 30 (10) 1989: 495-497.

Infras, IWW (2000) *External Costs of Transport*. Study on behalf of International Union of Railways (UIC), Paris.

Infras/IWW (2004) *External Costs of Transport – Update Study*. Study on behalf of International Union of Railways (UIC), Final Report, Zürich.

Jones, P. (2001) Gaining public support for road pricing through a package approach. T*raffic Engineering + Control* 32 (4) 2001: 194-196.

Lyons, G., Dudley, G., Slater, E., Parkhurst, G. (2004). *Evidence-base review – attitudes to road pricing,* Final report to the Department for Transport, University of the West of England, Bristol.

Nash, C., with contributions from partners (2003) *UNITE (UNIfication of accounts and marginal costs for Transport Efficiency)*, Final Report for Publication, Leeds, http://www.its.leeds.ac.uk/projects/unite/deliverables.html.

Ott, W., Baur, M., Iten, R., Vettori, A. (2005) Thorough implementation of the polluter-pays-principle. *Umwelt-Materialien*: Nr. 201. Federal Agency of Environment, Forest and Landscape (BUWAL), Bern. – in German.

German Advisory Council on the Environment (SRU) (2005) *Environment and Road Transport. High Mobility- Environmentally Sound Traffic.* special report, Berlin, excerpt on http://www.umweltrat.de/english/eframe02.htm – in German.

Saxon Department for Environment and Geology (LfUG) (Ed.) (2005) *Climate change in Saxony – status quo and prospects*. Dresden, http://www.umwelt.sachsen.de/lfug/ – in German.

Schade, J., Schlag, B. (2000) *Acceptability of Urban Transport Pricing*. VATT-Research Reports, Helsinki.

Schade, J., Schlag, B. (Eds.) (2003) *Acceptability of Transport Pricing Strategies*. Elsevier: Oxford.

Scharfe, S., Zimmermann, F. (2004) *Impacts of demography on future developments in the transport sector in Saxony*. Study on behalf of the Saxon Department for Environment and Geology, Dresden. – in German.

Saxon State Office of Statistics (Ed.) (2003) *Regionalised population forecast for Saxony by 2020*. Kamenz. – in German.

Spiekermann, K.; Wegener, M (2005) *Spatial impacts of measures for internalising external costs of transport in Saxony*. Final report, Dortmund. – in German.

WHO (1999) Health Costs Due to Road Traffic-Related Air Pollution, an impact assessment project of Austria, France and Switzerland, economic evaluation, technical report, London.

European Transport \ Trasporti Europei n. 38 (2008): 85-106

Costs and efficiency of highway concessionaires: a survey of Italian operators

Jérôme Massiani[1, 2*], Giorgio Ragazzi

[1] *Università degli studi di Bergamo – Italy*
[2] *Università degli studi di Trieste – Italy*

Abstract

Measuring the productivity of highway concessionaires is very relevant, especially when a price cap regulation is applied where tariff increases are based on expected improvements of productivity. Output may be measured in terms of traffic or network length, or a combination of both, while quality of service should ideally be accounted for. To measure productivity we consider only operating costs, as amortization and financial costs depend upon the original highway design and historical costs. A cross section analysis of the Italian concessionaires shows that: 1) operating costs depend on both traffic and capacity; 2) economies of scale are relevant but their estimate is very sensitive to the model specification; 3) there are large differences in efficiency among operators, indicating that there could be significant room for yardstick competition.

We subsequently consider the main economic data regarding the major Italian concessionaire (Autostrade spa) over two decades. Revenues increased greatly, even more than traffic, while operating costs remained substantially stable in real terms, as the automation of toll collection allowed the company to reduce the number of collectors by almost half. Finally, a comparison between Italian and French concessionaires shows that the latter have much lower operating costs, which cannot be entirely explained by economies of scale or lower personnel costs.

Keywords: Highway; Regulation; Productivity; Price-cap.

1. Introduction

In this article, we examine the concept and measurement of the productivity of highway concessionaires. The topic has become of fundamental relevance considering the major privatizations of concessionaries which have occurred in some European countries (Autostrade in Italy, ASF, SANEF, and SAPRR in France).

There are several reasons why the question of highway operators' efficiency becomes more relevant in a private-oriented competitive framework. A first reason is yardstick competition. If the regulator wants to use incentives to improve the efficiency of

* Corresponding author: jmassiani@units.it

operators, he needs indicators to compare actual with optimal cost levels for each operator. A second reason regards the relative merits of private vis-à-vis public ownership. Indeed, one of the reasons for advocating privatizations is the supposed greater efficiency of the private sector, although empirical evidence on this point still needs to be consolidated. Comparing efficiency of private versus public operators is a key element for the determination of highway policy. In a recent contribution, Benfratello et alii (2005), using a panel data approach, shed some light on the cost structure of the highway sector in Italy. They estimate a cost function for 20 Italian concessionaires for the period 1992-2003. Their results indicate that private ownership has a positive impact on productivity while regulatory regime (Price cap versus Rate of Return) has no effect on productivity.

Another reason to investigate highway operator efficiency is to determine the scope for scale economies and, thus, the most cost efficient market structure. Last but not least, the measurement of productivity changes is prerequisite for the implementation of price cap regulation. In Italy, for instance, tariff increases are determined as the sum of the change in the retail price index, minus the anticipated changes in productivity (usually referred to as the X factor), plus a quality premium based on accidents and road surface conditions (see Greco and Ragazzi, 2005, Benfratello and alii, 2006). Thus, in order to implement correctly the price cap regulation, regulatory authorities must have a clear understanding of the evolution of productivity both at the sector level and for each single operator.

In order to shed light on the issue of highway operator efficiency several methods can be used. Highway efficiency can be analysed through comparisons among various operators within a single country or across countries. Cross-country comparisons may provide useful information on how different ownership structures or regulatory systems may affect cost efficiency. One may also analyse how the costs of single operators change over time, and how such changes relate to changes in the operating framework of the industry (mainly changes in the market structure and in technology). Other methods rely on the analysis of simple indicators (typically operating cost/vehicle.km). A more comprehensive method relies on the estimation of cost functions. Eventually, elaborating on costs functions, Stochastic Frontier Analysis models can be used in order to estimate the degree of (in)efficiency of various operators.

In the present article, we make use of these various approaches in order to investigate highway operator efficiency. Section 1 is dedicated to the discussion of possible definitions of highway licensees' output, showing the implications of each definition. In Section 2, we estimate a cost function for Italian concessionaires based on a cross section of 18 highway operators for year 2006 and provide estimates of marginal costs for traffic and network as well as a measurement of efficiency of each concessionaire. We estimate also a stochastic cost frontier where an additional single sided disturbance, representing inefficiency, is added to the traditional stochastic disturbance present in the cost function estimate. Such method allows the computation of inefficiency for each single operator, that can be used for yardstick competition. Section 3 analyses the evolution of costs and revenues of Italy's major licensee over two decades. In Section 4, we compare Autostrade with three other main operators and we compare costs and revenues of Italian and French highway concessionaires.

2. How to define and measure productivity?

Productivity is the ratio between output and inputs. In the case of networks, how one should define output is far from clear or generally accepted. There are basically two different approaches: the first refers to traffic (appropriately taking into consideration its composition), the second to the capacity that is offered by the infrastructure.

If one considers output from the point of view of the (total) benefit obtained by the users, traffic would appear the best measure for output, although the quality of service should also be considered (safety, congestion, average speed etc.). If one considers instead the service provided by the operator, its output consists mainly in the provision of a certain capacity, which has a value (and costs) irrespective of the volume of traffic that goes through the infrastructure.

Traffic depends upon the original design of the network and the subsequent evolution of demand; the company managing the network cannot significantly impact the volume of traffic. However, certain costs increase with traffic, depending upon the network. Unlike other network industries (the cost of maintaining an electric grid may be independent from the watt-hours that go through it), in the case of highways, incremental traffic may require additional services (and additional costs) both for toll collection[1] and pavement repair. Traffic (especially HGVs) damages the pavement and thus causes additional costs. Damages may also derive from several other causes such as, for instance, climate (for a survey, see Bruzelius, 2004). It is therefore very difficult to measure the marginal cost of traffic regarding maintenance. Other costs, in particular collection, clearly vary in function of the traffic volume. However, traffic may not suffice to explain correctly operating costs. For instance, Link (2003), who considered operating costs (defined as "*maintenance, operation and renewals*") to be a function of traffic only, obtained models with relatively poor fitting[2].

Levinson and Gillen (1998) consider two components of highway production: "*in general, highway segments produce two outputs: traffic flow which require capacity in terms of the number of lanes, and standard axle loadings which require durability in terms of thickness of the pavement" (Levinson and Gillen, 1998, p. 207)*. Further on in their article, Levinson and Gillen use a definition of highway production as the traffic of various vehicle categories. Benfratello and alii (2005) consider that the output is traffic, but the costs also depend on network length. Others, for instance the Italian NARS[3], stress that measures of highway production expressed in terms solely of traffic provide misguiding evidence; according to them the indicators should refer to the costs of the network provided to road users, aside from the actual use that these users may decide to make.

---

[1] Collection is a service provided by the licensee, but does not add to the utility of users, being a deadweight cost for society.

[2] For a series of models estimated on data from Switzerland, Germany, and Sweden, the models' R^2 were ranging from 0,25 to 0,65.

[3] The NARS (*Nucleo consulenza Attuazione linee guida Regolazione Servizi di pubblica utilità*) is a committee of experts in charge of advising the Ministry of Economics and Finance regarding the regulation of public services.

In conclusion, output may be defined as made up of three components:
- provision of a given capacity,
- throughput of the traffic,
- quality of the service[4] (pavement, safety, collection systems, congestion etc.)

If data about the breakdown of operating costs for each of the three outputs were obtainable we could consider productivity separately for each of the three output components. Productivity in the provision of capacity could be estimated by comparing the network length with the operating costs dedicated to such purpose, and productivity in traffic handling could be estimated by comparing traffic volumes with costs related to toll collection and repairing pavement damage caused by traffic. It would be much more difficult to define a single index for quality. However, since a breakdown of operating costs is generally not available, in the following section we compare total operating costs to traffic and network size.

3. Cost function estimate and measure of efficiency of Italian concessionaires

In this section, we intend to measure the cost efficiency of Italian concessionaires. We first provide the results of a cost function estimation. We subsequently analyse how these results should be interpreted in terms of marginal costs. Eventually, we investigate the measure of inefficiency for the different operators.

3.1 Cost function estimation

We consider the concessionaires' production in terms of traffic and of road capacity. We do not consider the quality of service due to the limitations of the available quality index. Two types of models are used. The first estimates an average cost function and is based on the usual regression techniques. The second estimates a stochastic cost frontier where inefficiency is measured as (positive) deviation from this frontier. With regard to the measurement of inefficiency, we prefer to use the Stochastic Frontier Analysis rather than the class of methods based on Data Envelopment Analysis due to the deterministic nature of this last methodology.

A common simplification, made for the assessment of infrastructure maintenance costs, is the hypothesis of constant marginal costs, even if the evidence is not clear-cut. One of the most frequently advocated advantage is the possibility to use non linear cost functions incorporating variable marginal costs. Although attractive, the intuition of variable marginal costs finds only limited support in the literature: as observed by Link

[4] In the regulatory framework in use in Italy, quality improvements are measured (and corresponding increases in tariffs are granted) on the basis of two indicators: accidents and quality of pavement. This method appears unsatisfactory. Accidents depend primarily on traffic regulations and are to a large extent outside the control of the licensee company. In recent years, accidents have diminished because of the stricter enforcement of speed controls and other similar measures taken at national level, and the decline in accidents has been similar on state roads as on highways. Operating costs for safety improvements are mostly those for road panels, presumably small enough to be disregarded without appreciable effects on the measures of productivity.

(2003), *"in many cases the detected non-linearities were rather weak in the relevant range of traffic variables"* (see also Ozbay et al., 2001, Deller and Nelson, 1991). Consistent with such findings, the simplification of relying on constant marginal costs has been accepted in current highway investment assessment practice as, for instance, in the Federal Highway Administration guidelines (FHWA, 1982) that considers *"cost estimates of pavement wear as a fixed $/Equivalent Single Axle Load Mile"*.

In our models, we consider a cost function where operating costs depend on two variables: capacity and traffic. The most visible challenge is to disentangle the intrinsic correlation among these two variables and isolate the effect of each variable. The dependent variable, operating cost, is defined as the sum of the following costs: 1) raw materials, and intermediate goods; 2) services; 3) rental and leasing; 4) personnel. Data are taken from the annual reports of the concessionaire companies. Amortization and financial costs are not considered as they mostly depend upon the historical costs of the infrastructure and the length of the concession.

The independent variables are defined as follows: Capacity is expressed in weighted kilometres of highway (one kilometre of 3 lanes highway is supposed to be equivalent to 1.5 km of 2 lanes highway) and Traffic is expressed in terms of veh.km. This unit is preferred to other possible units: number of users, pcu.km (personal car units), t.km, ESAL.km (Equivalent Single Axle Load) or GVM.km (Gross Vehicle Mass.km) as it better fits with the purpose of our study. The number of transits would be useful to take into account the costs associated with toll collection but they would prove deceiving for other costs such as road maintenance. Pcu.km would rather be useful to understand traffic flow, ESAL.km or GVM.km would be apt for the estimating costs for pavement renewal but is not relevant for other expenses. Thus, considering that these various measurement units do not have advantages, we will stick to the measurement of traffic in terms of veh.km. We consider only the total flow of vehicles. We decided not to weight car traffic and HGV differently due to the relatively stable share of HGVs in total traffic among the different licensees. Note, as well, that due to the cross section nature of our data, the introduction of input prices in the cost function, that would be consistent with the micro foundation of the efficiency measures, would prove useless for our data: as input prices are invariant across our population the effect of these prices cannot be disentangled from the model's constant. We consider data for year 2006. We concentrate on one single year rather than using panel data. Panel data has already been implemented in previous works on highway concessionaires in Italy (Benfratello and alii (2005)) while we are not aware of any Stochastic Frontier Analysis based on cross section data.

Table 1 provides the data as well as some relevant ratios (cost/km and cost/veh.km) for the investigated concessionaires. A well known feature of Italian highway sector is the strong dichotomy among highway operators: Autostrade per l'Italia (ASPI), without considering its subsidiaries, operates a network of 2,855 km and 48.2 billion veh.km, which is more than half of the total highway traffic; the other concessionaires are notably smaller (Autostrada del Brennero, the second largest operator, accounts for 12 % of total highway traffic). Divergence from the mean is larger for concessionaires with a small network, see for instance RAV for cost/veh.km (11.8 eurocent per veh.km against an average of 3.6 eurocent) or Tangenziale di Napoli as well as Padova-Mestre for cost/km (1,845 and 771 thousand euro per km against an average of 504 thousand euro). This suggests the existence of non linearities together with possible heteroschedasticity that should be taken into account in the model estimation.

Table 1: Italian concessionaires, some descriptive data (2006)

Operator	*Network*	*Capacity*	*Operating costs*	*Traffic*	*Op. costs per km*	*Op. costs per veh.km*
	km	Weighted km (2004)	10^6 €	10^6 veh.km	10^3 €/km	€ cents/ veh.km
Autostrade per l'Italia (ex Autostrade)	2,855	3,324	923	48,214	323	1.9
Autovie Venete	189	182	64.7	2,629	342	2.5
MilanoMare	184	235	89	3,091	484	2.9
Padova - Mestre	41	54	31.6	1,148	771	2.8
SAM. Autostrade Meridionali	52	55	36.9	1,562	710	2.4
Torino - Savona	131	130	33.2	949	253	3.5
Brescia - Padova	182	256	132	5,175	725	2.6
Autostrada del Brennero	314	314	157.6	4,643	502	3.4
Torino- Milano	130	189	61.9	2,150	476	2.9
Torino- Piacenza	168	169	52.9	2,191	315	2.4
ATIVA (Torino- Val d'Aosta)	156	150	54.5	2,190	349	2.5
RAV (Raccordo Aut. Val d'Aosta).	27	27	10.4	88	385	11.8
Centropadane	89	97	26.4	1,007	272	2.6
SAV (Autostrade Valdostane)	68	60	21.6	405	318	5.3
Autostrada dei Fiori	113	115	59.8	1,333	529	4.5
SALT (Soc. Aut. Ligure Toscane)	155	154	61	2,070	394	2.9
SAT (Soc. Autostrada Tirrenica)	37	36	10.1	248	273	4.1
Autocamionale CISA	101	120	32.8	862	325	3.8
Consorzio per le Autostrade Siciliane	268	217	n.a.	1,753	n.a.	n.a.
Strada dei parchi	281	285	57.9	2,296	206	2.5
Tangenziale di Napoli	20	30	36.9	1,053	1,845	3.5
Mean (unweighted)	*265*	*295*	*101.5*	*4,050*	*504*	*3.6*

Based on these data, we estimate a set of costs function. We first estimate a linear model (a). Then we introduce a translog specification (model b), where all coefficients but $\log^2(K)$ are present in the equation and have a significant coefficient. A simplified translog specification is also provided as model (c) on the grounds that it is more parsimonious than the previous model and is nearly as satisfactory considering the usual fitting criteria. Eventually, model (d) is the estimation of a stochastic cost frontier based on model (c). Model (d) includes two error terms: one is the traditional normally distributed disturbance, the other one is a single sided disturbance that represents the inefficiency of each operator compared with the stochastic cost frontier. A similar approach has also been tested for model (a) and (b). However, due to non convergence of the algorithms used for estimation (a situation that is not infrequent in the field of efficiency estimation), such models could not be calibrated.

The models are:

$$co = \beta_0 + \beta_K.K + \beta_T.T + \varepsilon \qquad (a)$$

$$Log(co) = \beta_0 + \beta_T.Log(T) + \beta_{T2}.Log^2(T) + \beta_K.Log(K) + \beta_{TK}.Log(T).Log(K) + \varepsilon \qquad (b)$$

$$Log(co) = \beta_0 + \beta_K.Log(K) + \beta_{TK}.Log(T).Log(K) + \varepsilon \qquad (c)$$

$$Log(co) = \beta_0 + \beta_K.Log(K) + \beta_{TK}.Log(T).Log(K) + \varepsilon + u \qquad (d)$$

where co are operating costs (millions of euro), T is traffic (millions of veh.km), K is capacity (weighted kilometres) and ε is independently (but not necessarily identically) normally distributed disturbance and u follows a non-negative distribution.

The estimates have been made after exclusion of the concessionaire ASPI, considering that this concessionaire is lying far outside the scatter of observations and would have a strong leverage effect on the estimated coefficients. The "Autostrada dei Parchi" has also been excluded because, for historic reasons, it has anomalous, very low, costs per kilometre. "Consorzio Autostrade Siciliane" is not included for lack of data. Consequently, the model is estimated based on 18 concessionaires. The estimations have been made using Limdep package, and they are presented in Table 2. This table features, for each model, an indicator of the quality of fitting (whether adjusted R^2, or Log likelihood, whenever relevant), together with the Root Mean Square Error (RMSE) of the estimated operating costs (which eases the comparison among models when the dependent variable is transformed[5]), the number of observations, as well as the estimated coefficients together with the critical probability associated with their t statistics. Note that the frontier model is estimated with the maximum likelihood method.

[5] RMSE is not included for model (d), because it would not make sense to compare the forecast capability of a frontier model with other model.

Table 2: Estimate of costs function of highway concessionaires (2006 data)

	Model (a) Linear		Model (b) Translog 1		Model (c) Translog 2		Model (d) Frontier (half normal)	
Dependent variable	Costs		Log (Costs)		Log (Costs)		Log (Costs)	
Fitting	adjR^2	0.9305	adjR^2	0.9458	adjR^2	0.9367	LL	6.48
Number of obs		18		18		18		18
RMSE costs		9.39		7.15		8.53		
	Coeff.	P. value	Coeff.	P. value	Coeff.	P. value	Coeff.	P. value
Constant	1.169	0.80	2.849	0.00	3.036	0.00	2.883	0.00
Capacity (K)	0.112	0.14						
Traffic (T)	0.021	0.00						
Log(K)			0.504	0.01	-0.901	0.00	-0.904	0.00
Log(T)			-0.605	0.05				
$Log^2(T)$			0.271	0.01				
Log(K)*Log(T)			-0.593	0.02	0.145	0.00	0.146	0.00

Model (b) and (c) have been estimated using the White heteroschedasticity robust covariance method that corrects for heteroschedasticity of the error term.

Model (a) estimates a constant marginal cost of traffic while capacity has limited explanatory value as its coefficient is not significant at the 10% probability level[6]. Results with translog specification are more satisfactory considering the significance of the coefficients as well as the fitting criteria RMSE. Model (b) provides the best fitting based on the RMSE criteria. Model (c), although slightly inferior to model (b) considering the fitting criteria of RMSE is presented for two reasons. First, it is more parsimonious. Second, model (c) can be used as a base for the estimation of frontier models, whilst estimation of the frontier does not converge when the specification of model (b) is used. This last observation is not univocally interpretable as it may be due both to the intrinsic limitations of the estimation tools and processes or to the inadequacy of the functional form. The choice between specification (c) and specification (b) is however not anecdotal as it provides different indications on the scale economies. As will be illustrated further, while marginal costs of the traffic is increasing in model (b), while it is decreasing in model (c).

Model (d) estimates the stochastic frontier of the operators. The term representing inefficiency is distributed based on an half normal distribution distribution. Exponential and truncated normal have also been tested, but they were found to perform less well than the half normal distribution.

[6] The critical probability associated with the constant is high. However we keep this constant in the model considering the undesirable properties of models without a constant. Note as well that similar estimates based on 2004 data also resulted in a non significant constant, although the critical probability was lower in magnitude (see Massiani and Ragazzi, 2006, for more details).

3.2 Marginal costs

The understanding of marginal costs is not straightforward for models (b) and (c) as they produce a marginal cost that is function of traffic and/or capacity. To illustrate the economic meaning of equations (b) and (c), it is however possible to consider the marginal cost of traffic and capacity of given concessionaires. Table 3 indicates these marginal costs for three concessionaires that correspond to the quartiles of the concessionaires' population (based on increasing operating costs). For comparison purpose, the constant marginal costs of the linear model (model a) is also indicated in the right column.

Table 3: marginal costs of traffic and capacity for three different concessionaires (2006 data)

		Variable Marginal Cost				*ConstantMarginal Cost*	
Quartile (increasing operating costs)	Concessionnaire	Model (b)		Model (c)		Model (a)	
		Traffic	Capacity	Traffic	Capacity	Traffic	Capacity
		€ cent/ veh.km	10^3 €/km	€ cent/ veh.km	10^3 €/km	€ cent/ veh.km	10^3 €/km
Q1	Autocam. CISA	0.9	231	2.4	20		
Q2	Torino Piacenza	1.5	222	2.1	79	2.1	112
Q3	Autovie Venete	1.6	225	2.1	96		

The emerging pattern of the table is that, when using translog specifications, the estimates of the marginal costs are very sensitive to the specification of the model: while model (b) indicates sharply increasing marginal costs of the traffic and quite constant marginal costs of the capacity, model (c) indicates decreasing marginal costs of the traffic and sharply increasing marginal costs of the capacity. The marginal costs of the linear model, that are fixed by nature, have values that are within the minimum and maximum of the marginal costs of the translog models.

Our findings suggest that, while attractive due to its high level of flexibility the translog specification exhibit a high sensitivity of the results to the functional specification. This may be in favour of a more modest, linear model whose limitation of providing constant marginal costs may be acceptable considering the limited range of variability in the dimension of the concessionaires under scrutiny.

3.3 Inefficiency measures

Based on model (d), we estimate for each concessionaire the inefficiency, that is E($u \mid u+\varepsilon$). The estimation is based on the method presented in Jondrow et al. (1982). The results are presented in Table 4. Two considerations should be made. First, the estimation of inefficiencies is contingent upon the choice of the distribution for the term u, but the relative inefficiencies are usually found to be highly correlated between different distribution assumptions. This is confirmed in our case, where the correlation between single inefficiencies estimated using the half normal distribution and the ones using exponential distribution is 0.98. This suggests that, while an absolute interpretation of inefficiencies is not robust, the relative magnitude of inefficiencies is informative about the efficiency of each concessionaire. Second, the measure of inefficiency is contingent upon the specification of the cost function. This implies that a measure based on model (b) would provide different results. There is however considerable evidence that the impact of the specification of the cost function on the individual estimates is limited (cf. for instance the evidence collected, in other fields of applied economics, by Rosko and Mutter, 2007, p. 143).

Table 4 indicates the inefficiency of each concessionaire. Based on these data, one could conclude that operators like Tangenziale di Napoli, Autostrada dei Fiori, as well as SAV, RAV and Autostrada del Brennero exhibit a higher level of inefficiency, while Torino-Piacenza, SAT and Centropadane, are among the most efficient.

Table 4: Inefficiency measure for each concessionaire (model d) [7]

Autostrade Venete	1.08	ATIVA	1.09
Milano Mare	1.12	RAV	1.19
Venezia Padova	1.10	Centropadane	1.06
SAM	1.09	SAV	1.20
Torino - Savona	1.12	A. dei Fiori	1.34
Brescia - Padova	1.10	SALT	1.13
A. del Brennero	1.19	SAT	1.05
Torino Milano	1.11	A. della Cisa	1.15
Torino - Piacenza	1.07	Tangenziale di Napoli	1.22

Our analysis suggests, however, that more effort should be dedicated to the analysis of the efficiency of highway operators to implement "yardstick competition".

3.4 Toll collection costs

Eventually, one may want to consider how much these compared efficiencies may be affected by one single identifiable cost, that is the cost of toll collection. A rough estimate of the efficiency in toll collection may be obtained by comparing the personnel employed in collection with traffic volumes.

[7] The inefficiency measure is given as $\exp(E(u \mid u+\varepsilon))$. Thus a figure of 1.20 indicates an inefficiency equal to 20% of the minimum operating costs.

Table 5: Toll collection costs of concessionaires (2004)

	Toll collection staff	*Toll collection staff/ km*	*Toll collection staff/ 10^9 veh.km*
Autostrade per l'Italia	2,760	0.97	59
Autovie Venete	267	1.48	118
Milano Mare	454	2.48	153
Autostrade del Brennero	398	1.27	88
RAV (Raccordo Autostradale Val d'Aosta).	8	0.30	99
Centropadane	72	0.81	80
SALT (Società Autostrade Ligure Toscane)	194	1.26	97
Autocamionale CISA	61	0.51	74
Strada dei parchi S.p.A	293	1.04	133
Tangenziale di Napoli	288	14.24	278

Remark: only concessionaires whose information about employees categories was sufficiently detailed could be included in this table.

As illustrated in Table 5, differences are very marked: Autostrade per l'Italia (ASPI), the major licensee, employed 59 collectors per billion vehicle.km, compared to 153 by "Milano-Mare" and 278 by "Tangenziale di Napoli". However, such differences can not be simply attributed to different degrees of efficiency since they also depend on factors such as the length of the network, the number of gates and the average travelling distance of vehicles on each concessionaire's network.

4. ASPI: a twenty years case study

In this section, we investigate the historic evolution of the productivity of "Autostrade" which in 2003 changed its name to "Autostrade per l'Italia" (ASPI), excluding the subsidiaries that manage other highway sections as well as other subsidiaries which deal with activities that are not strictly related to highway operation[8]. Indeed, the group went through major organisational changes in 2003, while the activity of the company operating the highway has remained stable over time.

We consider the years 1985 to 2005. Table 6 provides the following information: 1) Output is expressed in terms of network length (km of network) and in terms of traffic (millions of veh.km). The composition of traffic is not considered because it shows a stable pattern during the whole period[9]; 2) Revenues[10]; 3) Workforce (at year end) as

[8] For instance, from 1996 on, the consolidated accounts also include Pavimental, a company operating in road works that accounted for 7 % of the group turnover in 1997. Less important , but even more remote from highway operation, is the activity of Autostrade Telecomunicazioni created in 1996.
[9] The maximum share of personal cars is 78 % in 1987, the minimum is 75,8 % in 2004.
[10] For years 1985-1995, data are from R&S annual yearbooks (Mediobanca) and revenues are defined as total sales ("*fatturato lordo*"). For years 1996-2005 data are from the company's financial reports and revenues are defined as the value of production ("*valore della produzione*"), i.e. Sales ("*fatturato*") plus change in work in progress ("*variazione dei lavori in corso*").

well as toll employees (collectors); 4) Operating costs[11], indicating separately "personnel costs" and "goods and services" (total operating costs include also the value of stock variation which is not detailed in the table). Subsequently table 7 concentrates on the most relevant ratios (revenues per km and veh.km, costs per km and veh.km as well as personnel costs/employee).

All euro data are homogenised at 2004 prices. The deflator is the production price index of industrial goods as provided in the National Institute of Statistics (ISTAT) yearbooks. To ensure homogeneity of data, the same deflator is also applied to deflate personnel costs. Revenues and operating costs at current prices are reported in the appendix (table 12).

Table 6: descriptive data of Autostrade, 1985-2005

Year	Network	Traffic	Employees			Revenues	Operating costs		
			Toll employees	Others	Total		Goods and services	Personnel costs	Total
	km	10^6 veh.km				(10^6 € 2004)			
1985	2,632	22,049	3,979	2,891	6,870	1,071	257	224	480
1986	2,674	23,696	4,194	3,051	7,245	1,251	304	249	552
1987	2,774	25,804	4,351	3,269	7,620	1,405	390	280	669
1988	2,791	27,841	4,581	3,524	8,105	1,396	440	311	746
1989	2,796	29,963	4,692	3,680	8,372	1,419	420	339	743
1990	2,796	31,190	4,771	3,757	8,528	1,460	334	358	678
1991	2,796	31,759	4,761	3,690	8,451	1,605	411	389	783
1992	2,799	33,027	4,735	3,698	8,433	1,699	472	407	824
1993	2,799	33,238	4,644	3,679	8,323	1,627	382	404	773
1994	2,816	34,176	4,419	3,568	7,987	1,707	317	439	747
1995	2,854	35,383	4,266	3,631	7,897	1,704	330	434	757
1996	2,854	36,035	4,169	3,568	7,737	1,753	346	401	740
1997	2,854	37,554	3,995	3,437	7,432	1,800	393	403	786
1998	2,854	39,260	3,832	3,428	7,260	1,920	426	385	805
1999	2,854	40,359	3,568	3,518	7,086	2,070	513	392	929
2000	2,854	41,810	3,366	3,527	6,893	1,953	458	361	818
2001	2,854	43,315	3,180	3,510	6,690	2,148	469	347	820
2002	2,854	44,603	3,098	3,478	6,576	2,273	443	360	801
2003	2,854	45,858	2,930	3,452	6,382	2,382	483	350	833
2004	2,855	46,703	2,760	3,602	6,362	2,516	500	343	848
2005	2,855	46,769	2,633	3,308	5,941	2,535	523	331	862

[11] Operating costs are the sum of personnel costs (*"costi per il personale")* plus purchases of goods and services (*"acquisti e prestazioni di terzi, costi diversi di esercizio")* minus the increase of work in progress (*"variazione lavori in corso")*. For the years 1985-1995, data are from R&S annual yearbook (Mediobanca). For the years 1996-2005 data are from the company's financial reports.

The length of the network increased very little up to 1995, and not at all thereafter[12], while traffic more than doubled. Revenues (at constant 2004 prices) increased more than traffic as real tariffs (revenues per veh.km at constant prices) increased from 4.86 eurocents per veh.km in 1985 to 5.42 eurocents in 2005. Real revenues per km increased from 407,000 euro in 1985 to 597,000 in 1995 and to 888,000 in 2005 (2004 prices).

Operating costs per km (table 7), although somewhat variable from year to year, after an initial increase to 267,000 euro (2004 prices) in 1988, remained relatively stable around this level for the following decade. After the privatization (with a peak in costs in 1999) operating costs per km increased from 287,000 euro in 2000 to 302,000 euro in 2005 (2004 prices). We do not know if and to what extent the increase of costs for the purchase of goods and services after privatization was due to higher spending for road resurfacing.

Operating costs per veh.km declined from 2.7 eurocents in 1988 to 2.0 eurocents in 1996 and diminished only slightly thereafter (but for an exceptional peak in 1999). The decline of operating costs per km, in spite of the sharp increase in traffic, is essentially due to the increase of efficiency in collection. The introduction of automated collection systems, which started in the early '90s, made it possible to reduce the number of collectors (personnel employed in toll collection) from a peak of 4,735 in 1992 to just 2,663 in 2005. This decline had already occurred, to a large extent, before privatization. Other employees declined somewhat from the early'90s to around 3,400 before privatisation and remained stable thereafter. Total personnel costs declined in real terms, in spite of the substantial increase of real average wages (see table 7).

[12] This holds even when one considers the number of lanes offered by the highway. Actually, if we take into consideration this element, the increase in capacity is only 10 % between 1987 and 2004.

Table 7: unit costs and revenues of ASPI (1985-2005)

Year	Revenues/km	Revenues/veh.km	Cost/km	Cost/veh.km	Personnel costs/ employee
	10^3 € 2004/km	€ cent/veh.km	10^3 € 2004/km	€ 2004/veh.km	10^3 € 2004
1985	406.9	4.9	182.4	2.18	32.6
1986	467.7	5.3	206.6	2.33	34.4
1987	506.5	5.4	241.3	2.59	36.7
1988	500.0	5.0	267.4	2.68	38.4
1989	507.4	4.7	265.6	2.48	40.5
1990	522.3	4.7	242.3	2.17	42.0
1991	574.0	5.1	280.1	2.47	46.0
1992	607.1	5.1	294.2	2.49	48.2
1993	581.1	4.9	276.0	2.32	48.6
1994	606.0	5.0	265.3	2.19	55.0
1995	597.0	4.8	265.1	2.14	54.9
1996	614.4	4.9	259.2	2.05	51.9
1997	630.5	4.8	275.2	2.09	54.3
1998	672.7	4.9	282.1	2.05	53.0
1999	725.4	5.1	325.5	2.30	55.3
2000	684.2	4.7	286.7	1.96	52.4
2001	752.5	5.0	287.2	1.89	51.9
2002	796.4	5.1	280.8	1.80	54.7
2003	834.6	5.2	291.9	1.82	54.8
2004	881.4	5.4	297.0	1.82	53.9
2005	888.0	5.4	301.8	1.84	55.8

Figure 1 provides a graphical representation of the main indicators[13]. We may summarize the main findings as follows: 1) there is no evidence of any gain in efficiency following privatization; 2) revenues per veh.km. increased by more than the price index (production prices of industrial goods), i.e. tariffs increased in real terms, from 1995 on; 3) this, and the sharp increase in traffic, caused an even larger increase of revenues while operating costs remained substantially stable; 4) there is no evidence that the increase of traffic appreciably increased operating costs; actually, the automation of collections allowed the company to sharply reduce the number of collectors.

[13] In the year 1999, when the company was privatized, there was an exceptionally high increase of both revenues and costs. The decrease from 1999 to 2000 is due to the fact that the production prices index increased by more than nominal revenues.

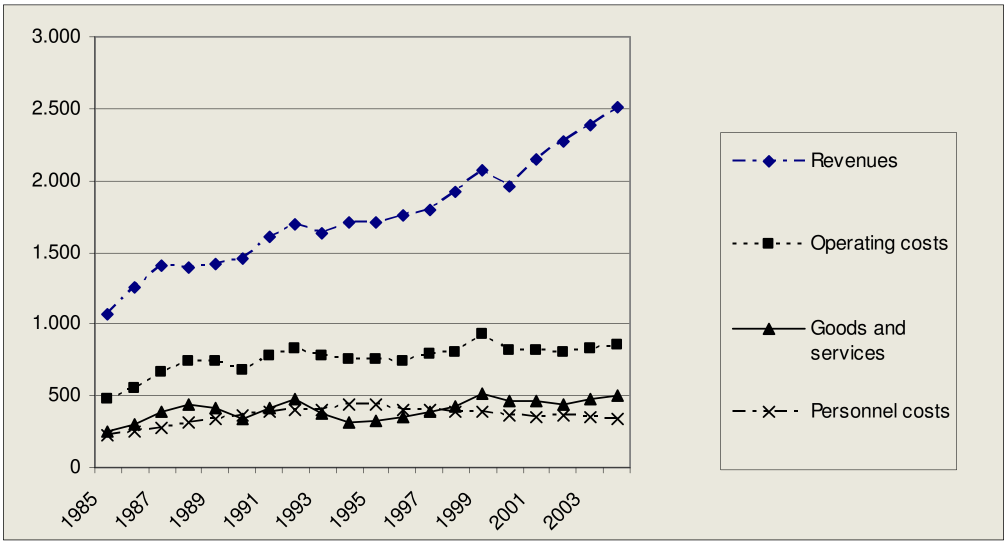

Figure 1 - costs and revenues of ASPI (1985-2004, million euro, 2004 prices)

Amortization and provisions are another major component of total costs, in addition to operating costs and financial charges. Since the company invested very little from the early '90s on, over this period amortization and provisions remained substantially constant in monetary terms (see table 13 in the appendix) and declined in real terms, from over 60% of operating costs in the mid '90s to 40 % in 2004 (excluding goodwill amortization[14]). From 1995 to 2004, amortization plus operating costs declined by 4% to 1.18 billion euros (at 2004 prices) while revenues increased by 48% to 2.51 billion euros.

5. Comparison among operators

5.1 Comparing Autostrade with three other highway operators in Italy

In this section, we compare ASPI with three other major concessionaires: Brescia-Padova (BSPD), Autostrada del Brennero (BREN), Autostrada Torino-Milano (TOMI) excluding their subsidiaries.

The data considered (table 8) are: network length (kilometres), traffic (light vehicles + heavy vehicles) expressed in millions of veh.km, operating costs (purchase of goods and services + personnel costs), total number of employees (and the number of toll collectors when available), revenues[15]. Operating costs and revenues are expressed in 2004 euro using the production price index. Revenues include, in addition to highway tolls, other incomes, mainly sub-concession fees paid by restaurants and petrol stations.

The network length of all four licensees remained unchanged; traffic increased by 30-35%, with the exception of TOMI where traffic increased by only 17% perhaps due to

[14] From 2003 on, amortization more than doubled, but this was entirely due to the amortization of the "book" capital gain ("avviamento") following the group reorganization.

[15] Revenues are defined as "*valore della produzione*", ie. Sales ("*fatturato*") plus change in work in progress ("*variazione dei lavori in corso*").

works which reduced substantially the potential traffic flow. Comparing revenues to traffic we observe that the average toll (at constant prices) declined for BSPD, remained about unchanged for BREN and increased instead sharply for TOMI, whose revenues increased by twice as much as traffic. Also revenues of ASPI increased by much more than traffic, but this was due mostly to higher income from royalties and sub-concessions while real tolls did not increase much.

Operating costs per veh.km declined by 14-17%, except for TOMI (table 9). This was due mostly to the increasing use of automated collection systems which allowed a sharp cut in personnel employed in collection, particularly relevant in the case of ASPI. ASPI has the lowest operating costs per veh.km, almost half those of BREN.

The very steep increase of real profits in this period is the consequence of revenues increasing by much more than operating costs, while capital costs (depreciation and financial costs) declined in real terms.

Table 8: Comparison of Autostrade with three other concessionaires (1997-2006)[16]

a - Network, costs and revenues

	Network			*Traffic*			*Operating costs*			*Revenues*		
	kilometres			(10^6 veh.km)			(10^6 € 2004)			(10^6 € 2004)		
	1997	2006	Δ	1997	2006	Δ	1997	2006	Δ	1997	2006	Δ
ASPI	2,854	2,855	0%	37,554	48,214	28%	786	840	7%	1,800	2475	38%
BSPD	183	183	0%	3,864	5,175	34%	106	120	13%	178	211	19%
BREN	314	314	0%	3,437	4,643	35%	129	144	12%	191	249	30%
TOMI	127	127	0%	1,838	2,150	17%	46	56	22%	88	120	36%

b - Employees

	Employees								
	Total			Toll employees			Other employees		
	1997	2006	Δ	1997	2006	Δ	1997	2006	Δ
ASPI	7,432	5,695	-23%	3,995	2,522	-37%	3,437	3,173	-8%
BSPD	835	708	-15%						
BREN	864	946	9%	407	388	-5%	457	558	22%
TOMI	457	459	0%	215			242		

[16] Brennero Highway costs include the use of "renewal fund" ("fondo di rinnovo"). Operating costs of the Highway Brescia-Padova show large fluctuations over the years - around 100 millions euro from 1997 to 2000, around 80 million euros from 2001 to 2003 and around 120 thereafter. This is due essentially to variations in the cost of external services ("costo per i servizi"). Data for the highway Torino-Milano are difficult to estimate, because the company was merged into SATAP (a company that operates the highway between Torino and Piacenza) in 2003. Moreover, revenues and operating costs are affected by the construction of a high speed rail track along the highway. Part of the construction operations have been undertaken by the highway operating company and reimbursed by the rail company. Costs and revenues of such activities have been estimated and excluded from the figures shown in the table, which thus refer only to activities pertaining to the highway

Table 9: Comparison of Autostrade with three other concessionaires, unit costs (1997-2006)

	Cost/network km (10⁶ € 2006)			Cost/10^6 veh.km (€ cent 2006)			Revenues/veh.km (€ cent 2006)		
	1997	2004	Δ	1997	2004	Δ	1997	2004	Δ
ASPI	0.28	0.29	7%	2.09	1.74	-17%	4.79	5.13	7%
BSPD	0.58	0.66	13%	2.74	2.32	-15%	4.61	4.08	-11%
BREN	0.41	0.46	12%	3.75	3.10	-17%	5.56	5.36	-3%
TOMI	0.36	0.44	22%	2.50	2.60	4%	4.79	5.58	17%

Costs per million of veh.km for three operators declined markedly, mainly due to the automation of collection which allowed a sharp reduction in the number of collectors, especially by ASPI. ASPI has the lowest unit operating costs. Regarding cost per kilometre of highway, Brescia - Padova (BSPD) costs are more than double compared with those of ASPI, and they exhibit the sharpest increase over the period. The Brenner highway has the highest costs per veh.km, but it succeeded in reducing costs more than the others[17].

5.2 Comparison between Italian and French highway operators

In this section we compare the operations of highway concessionaires in France with those in Italy. There are eight highway concessionaires in France, six of them are part of three groups, namely: ASF (Autoroutes du Sud de la France together with ESCOTA - autoroutes Esterel Côtes d'azur Alpes), SANEF (Société des Autoroutes du Nord et de l'Est de la France together with SAPN- Société des Autoroutes Paris Normandie) and APRR (Autoroutes Paris Rhin Rhône together with AERA). There is a rough geographical split of the highway network with ASF operating in the southern part of the country, SANEF in the area north and east of Paris and APRR in the Paris-Lyon corridor and in the Alps region. The two other concessionaires are Cofiroute (Paris-Bordeaux Corridor with some extensions in south-west France) and Alis (which started operations in 2005 on a 125 km route in Normandy).

[17] In its bookkeeping, Brennero highway makes use of a special fund called renewal fund. In the computation of costs, we take into account the use of this fund. This however makes the computation of costs subject to more uncertainty as it gives the company some discretionality in the use of the fund.

Table 10: Descriptive data of highway concessionaires in France (2005 data)

Group	*Operator*	*Network size*	*Traffic*	*Staff*	*Revenues*	*Operating costs*		
						Purchase of goods and services	*Personnel costs*	*Total*
		km	veh.km	units	10^6 € (2005)			
SANEF Group		1,742	14,200	N. A.	1,152	108	142	249
incl.	SANEF	1,374	11,048	2,380	N. A.	N. A.	N. A.	N. A.
incl.	SAPN	368	3,198	728	265	39	32	71
ASF Group		3,422	32,603	7,975	2,474	218	336	554
incl.	ASF.	2,963	26,332	5,665	1,958	158	258	416
incl.	ESCOTA	459	6,271	1,828	516	60	78	138
APRR Group		2,205	19,989	4,391	1,571	155	190	345
incl.	APRR	1,810	15,896	3,236	1,210	111	146	257
incl.	AREA *	384	4,047	1,143	361	44	44	88
Cofiroute		928	9,041	1,919	889	91	89	180

Note: AREA data are for year 2003.

Revenues of French operators (Table 10) are almost entirely from tolls, with only a few million coming from sub-concessions, which represent instead a sizeable portion of revenues of Italian operators.

Table 11: Operating ratios of French highway concessionaires and comparison with Italian concessionaires (2005 data, current prices, unless specified)

Group		*Operator*	*Traffic intensity*	*Operating costs/ network km*	*Operating costs/ veh.km*	*Revenues**/ network km*	*Revenues**/ veh.km*
			10^6 veh.km/ km	10^3 €/km	€ cent/ veh.km	10^3 €/km	€ cent/ veh.km
SANEF Group			8.2	143	1.8	661	8.1
	incl.	SANEF	8.0	N. A.	N. A.	N. A.	N. A.
	incl.	SAPN	8.7	193	2.2	719	8.3
ASF Group			9.5	162	1.7	723	7.6
	incl.	ASF.	8.9	140	1.6	661	7.4
	incl.	ESCOTA	13.7	301	2.2	1,124	8.2
APRR Group			9.1	156	1.7	712	7.9
	incl.	APRR	8.8	142	1.6	669	7.6
	incl.	AREA *	10.5	229	2.2	940	8.9
Cofiroute			9.7	194	2.0	958	9.8
Weighted Average France (2005)			9.1	160	1.8	734	8.0
ASPI (2005)			16.4	314	1.9	924	5.6
Weighted Average Italy (without ASPI) (2004)			13.2	379	3.1	710	6.2

* AREA data are for year 2003.
** Revenues are defined as: turnover ("*chiffres d'affaires*") for French concessionaires, net toll revenues ("*ricavi netti da pedaggio*") for Italian concessionaires, except for ASPI where it refers to toll and concession revenues.

Traffic intensity in France is well below that of Italy (Table 11). In spite of this, the operating costs per veh.km of Italian concessionaires are more than 50% higher than those of the French concessionaires, and their operating costs per km are more than double. This difference is partially due to the fact that average personnel costs are 16% higher in Italy (the average annual cost per employee is around 44,000 euro for French concessionaires (2005) and around 51,000 euro in Italy (2004)). Another reason may be the very large difference in the size of the operators in France and in Italy. Although scale economies did not clearly emerge from the analysis of 18 Italian operators, we are unable to exclude the relevance of scale economies for large size differences; this is consistent with the observation that ASPI has much lower operating costs than all the other smaller concessionaires in Italy. Differences in operating costs in the two countries are however strikingly large and this would certainly deserve further investigation.

6. Conclusions

Measuring the productivity of highway concessionaires is very relevant, especially if a price cap regulation is applied. Productivity of highway concessionaires is generally defined as the ratio of traffic to costs. However, the volume of traffic is outside the control of the operating company, depending mostly upon the original design of the infrastructure and the growth of the economy. The output of a company operating an existing infrastructure may best be measured in terms of the provision of a given capacity plus incremental services for traffic, including quality of service. To measure productivity one should consider only operating costs, since amortization and financial costs depend upon historical investment costs and length of the concession.

A cross section analysis of 18 Italian concessionaires shows that:1) operating costs depend on both traffic and capacity (size of the network); 2) economies of scale may be relevant, but they do not emerge clearly on the basis of our estimations. Translog specifications, that would be suitable for the description of scale economies, provide sharply different estimates of scale economies for models with slightly comparable fitting; 3) based on Stochastic Frontier Analysis, we find large differences in cost efficiency among operators, suggesting that there is room for yardstick competition.

Data over two decades for the major Italian concessionaire indicate that: 1) the volume of traffic doubled and tariffs were also increased in real terms, thus revenues per network km (at constant prices) more than doubled, reaching 3 times operating costs; 2) the increase of traffic did not noticeably increase operating costs (at constant prices), as the automation of collections allowed the company to sharply reduce the number of collectors; 3) there is no evidence of significant gains in efficiency following privatization.

The analysis of three other main italian concessionaires, over the period 1997-2004, confirms that the increase in traffic did not result in comparable increases in operating costs, while there are large differences in cost efficiency among operators.

Finally, a comparison between Italian and French concessionaires shows that the latter have much lower operating costs, which cannot be entirely explained by economies of scale or lower personnel costs.

On the whole, the evidence that is collected in this article casts doubt on the validity of the competitive framework prevailing in the highway industry in Italy. There is no evidence that the privatisation of Autostrade improved efficiency, costs in the industry are much higher than in France, revenues have increased more than costs leading to the creation of large rents that regulation should have avoided.

References

Benfratello, L., Iozzi, A. and Valbonesi, P. (2005), “Privatisation, regulation and productivity in the Italian motorway industry”, Marco Fanno Working Paper n 2. Università di Padova.

Benfratello, L., Iozzi, A. and Valbonesi, P. (2006), "Autostrade", *Rivista di Politica Economica*, March-April 2006, pp. 329-364.

Bruzelius, N. (2004), “Measuring the marginal cost of road use. An international survey”, Swedish National Road and Transport Research Institute, VTI medelande 963A, 54 p.

Deller, S.C. and Nelson C.H. (1991) "Measuring the economic efficiency of producing rural road services", *American Journal of Agricultural Economics*, Vol. 73, 1, pp. 194–201.

Federal Highway Administration (FHWA) (1982) "Final report on the federal highway cost allocation study: report of the secretary of transportation to the United States congress", Washington DC.

Greco, A. and Ragazzi, G. (2005) “History and Regulation of Italian Highway Concessionaires”, in Ragazzi, G. and Rothengatter, W. (editors) “*Procurement and Financing of Motorways un Europe”*, Elsevier, Amsterdam, pp. 121-133.

Jondrow, J., Lovell, C. A. K., Materov I. S. and Schmidt P. (1982), "On the estimation of technical inefficiency in the stochastic frontier production function model", *Journal of Econometrics*, Vol. 19, pp. 233-218.

Levinson, D. M. and Gillen D. (1998) "The full cost of intercity highway transportation", *Transportation Research D* , Vol. 3, 4: pp. 207-223.

Link, H. (2003) "Estimates of marginal infrastructure costs for different modes of transport" *43rd Congress of the European Regional Science Association*: 22 p.

Massiani, J., Ragazzi, G. (2006), "Production and productivity of Italian highway concessions” *Scientific meeting of the Società Italiana d'Economia dei Trasporti (Italian society of Transport Economics).* Trieste, June 2006. Published in: I trasporti ed il mercato globale, Edited by Polidori G., Borruso G., Danielis R., Franco Angeli editor, Milano, pp. 277-285.

Mediobanca, Annuario R&S (Ricerche e Studi), yearly edition from 1985 to 2005, Milano.

Ozbay, K., Bartin, B and Berechman J. (2001), "Estimation and evaluation of full marginal costs of highway economics in New Jersey", *Journal of Transportation Statistics*, Vol. 4, 1, pp. 81-103.

Ragazzi, G., (2004), Politiche per la regolamentazione del settore autostradale e il finanziamento delle infrastrutture, *Economia Pubblica*, 34(4), pp. 5-33.

Rosko, M. D., and Mutter, R. L. (2007), Stochastic Frontier Analysis of Hospital Inefficiency: A Review of Empirical Issues and an assessment of robustness, *Medical Care Research and Review*.

Appendix

Table 12: ASPI - Revenues[18] and operating costs at current prices

	Revenues 10^6 € (current prices)	*Total Operating costs* 10^6 € (current prices)	*Income/veh.km* € cent/km (current prices)
1985	639	286	2.9
1986	747	330	3.2
1987	803	412	3.1
1988	889	476	3.2
1989	958	501	3.2
1990	1,026	476	3.3
1991	1,165	569	3.7
1992	1,258	610	3.8
1993	1,248	593	3.8
1994	1,359	595	4.0
1995	1,463	650	4.1
1996	1,535	647	4.3
1997	1,595	696	4.2
1998	1,704	714	4.3
1999	1,833	822	4.5
2000	1,833	768	4.4
2001	2,055	784	4.7
2002	2,179	768	4.9
2003	2,319	811	5.1
2004	2,516	843	5.4
2005	2,637	896	5.6

[18] Revenues refer to gross turnover ("*Fatturato Lordo*") for years 1985-95 and production value (*Valore della produzione*) from 1996 on.

Table 13: ASPI - Allowances for maintenance and amortization funds

Year	*Amortization*					*Provisions for maintenance fund*	*Total (amortization + provisions)*	
	Amortization of goodwill	Deferred charges	Financial	Industrial	Total			
	10^6 € 2004							10^6 € (current prices)
1985		1	150	152	**303**		**303**	181
1986		1	194	187	**382**		**382**	228
1987		3	125	219	**347**		**347**	213
1988		4	155	213	**372**		**372**	237
1989		6	172	205	**383**		**383**	259
1990		7	179	220	**407**		**407**	286
1991		10	197	214	**421**		**421**	305
1992		11	212	214	**436**		**436**	323
1993		10	228	207	**445**		**445**	341
1994		9	248	197	**455**		**455**	362
1995		8	283	182	**474**		**474**	407
1996		7	268	53	**328**	76	**404**	354
1997		7	140	58	**206**	196	**401**	356
1998		7	141	54	**202**	247	**450**	399
1999		8	144	57	**209**	194	**403**	357
2000		10	137	65	**212**	101	**313**	294
2001		11	135	68	**214**	144	**358**	**343**
2002		13	139	76	**227**	124	**352**	**337**
2003	448	28	107	52	**635**	144	**779**	**759**
2004	436	34	108	45	**624**	151	**775**	**775**

Source: R&S yearbook until 2000. Annual Reports from 2001 on.

European Transport \ Trasporti Europei n. 38 (2008): 107-118

Willingness-to-pay of public transport users for improvement in service quality

L. Eboli [1], G. Mazzulla [1*]

[1] *University of Calabria – Faculty of Engineering*
Department of Territorial Planning
P. Bucci, cubo 46/B, 87036, Rende (CS)

Abstract

In this paper, passenger willingness-to-pay (WTP) for improving the quality levels of a bus service is examined. Specifically, the objective of this research is to provide a tool for evaluating passenger willingness-to-pay by considering some qualitative service aspects, in addition to the traditional quantitative service aspects like travel time and cost. The adopted methodology is built on the calibration of behavioural models based on user choices. The WTP values are obtained as marginal rates of substitution between some service quality attributes and travel cost at constant utility. For this purpose, Multinomial and Mixed Logit models are introduced. The models were calibrated by using the data collected from an SP experiment in which each user makes a choice between an alternative representing the current service and two alternatives representing hypothetical bus services. In order to take into account the randomness of the estimated WTP, the limits of the confidence intervals are calculated.

Keywords: Service quality; Public transport; Willingness-to-pay.

1. Introduction

In the field of public transport, service quality measure is a subject of the greatest interest both for planners and transit operators. Generally, service quality is measured by asking the users their perceptions and expectations about some service quality aspects. By considering the importance and satisfaction levels stated by users, the service quality attributes to be improved can be identified.

A service quality measure can be obtained by discrete choice models based on the Random Utility Theory (RUT), and particularly by Logit models. Over the last few decades, Logit models have been widely used for the calibration of the mode choice models in which the alternatives are different transport modes. However, more recently "within mode" models have been proposed, in which the alternatives relate to a single

* Corresponding author: Laura Eboli (laura.eboli@unical.it)

transport mode, usually public transport mode. In the specific case of service quality each alternative is a bus service characterized by some service quality attributes. Some Logit models, like Multinomial, Nested or Mixed Logit, were proposed by Hensher (Prioni and Hensher, 2000; Hensher, 2001; Hensher and Prioni, 2002; Hensher et alii, 2003). By means of the coefficient estimation of these models, the importance of service quality attributes on global service quality is evaluated.

These models can be calibrated by using the combination of Revealed Preferences (RP) and Stated Preferences (SP) data. The SP data applications have assumed a growing importance in the last few decades. The major advantage of SP data compared with RP data is that they exploit a more extensive attributes space (Pearmain et alii, 1991).

From Logit models a subjective value of time can be derived; this value represents the user willingness-to-pay in terms of monetary cost for savings in travel time. The concept of value of time was extended to the widest concept of willingness-to-pay (WTP) in order to evaluate in monetary terms some external effects of transport systems, like accidents, air pollution, noise, and landscape deterioration. The WTP measures represent an important tool in the valuation of transport investments, because they allow the rate which could be debited to the users to be established.

In this paper, the WTP concept was adopted in order to evaluate willingness-to-pay of public transport users for an improvement in quality of service. To this purpose some Logit models in which the choice alternatives are some *bus services* were introduced. The rest of the paper is organized as follows: section 2 presents an overview of some methods for measuring consumers' willingness-to-pay; section 3 introduces a theoretical background of the discrete choice Logit models; in section 4 the experimental context is described and the statistical-descriptive results of the survey realized to support the research are reported, this section also discusses the estimation results; finally, section 5 summarises the main conclusions.

2. Willingness-to-pay measures

On the basis of the assumption that consumer choices reflect their preferences, it is possible to deduce from choice behaviour or from direct questions about preferences, whether transportation improvements or public policy initiatives are socially desirable (McFadden, 1997). A quantitative measure of the social desirability of improvements can be obtained by the WTP valuation. In the literature different WTP valuation methods have been proposed. The most widely used approaches are the Hedonic Pricing Method (HPM) and the Contingent Valuation (CV) method.

The HPM relies on actual behaviour observed in the housing market, while the CV method (known in marketing as Conjoint Analysis, CA) relies on respondents' statements about their willingness to pay for a hypothetical improvement of a transport system. The HPM has been specifically used to estimate the environmental externalities, like traffic noise, air pollution, urban development, transport safety, and so on (see for example, Garrod and Willis, 1999; Freeman, 2003; Jim and Chen, 2007).

The determination of WTP by means of SP data has traditionally been associated with the CV method. The CV method consists in asking people how much they are willing to pay in monetary cost for a benefit; analogously, the Willingness-to-Accept (WTA) in compensation for deterioration can be calculated. A number of studies have been proposed in order to valuate WTP for reducing traffic air pollution and noise (Feitelson et alii, 1996; Saelensminde, 1999; Ortùzar and Rodrìguez, 2002; Bjorner, 2004; Fosgerau and Bjorner, 2006), for reducing road accidents (Rizzi and Ortùzar, 2003; Iraguen and Ortùzar, 2004), for saving travel time (Brownstone et alii, 2003; Hensher and Goodwin, 2004; Hensher, 2006a; Hensher, 2006b), for improving transport information services (Mehndiratta et alii, 2000; Denant-Boèmont and Petiot, 2003; Khattak et alii, 2003; Molin and Timmermanns, 2006), for improving the paved road surface (Walton et alii, 2004), and for not losing one's driving licence (Jorgensen and Wentzel-Larsen, 2002; Jorgensen and Dargay, 2007). In the specific case of public transport service quality, Ramanayya et alii (2007) measured the willingness-to-pay for better services across different categories of commuters by asking them their willingness to pay higher fares for an assured seat, for a comfortable journey, for fast service, and to accommodate luggage. On the other hand, Espino et alii (2006a) proposed a discrete choice model between the private and public transport mode in order to estimate willingness-to-pay for better bus services in terms of frequency increases, reduction in walking time, and improvements in the level of comfort.

Traditionally, WTP for savings in travel time (in the classic transport microeconomic literature normally referred to as the subjective value of time) has been estimated by using mode choice models based on RUT, by considering travel time and cost attributes in the utility function of the modal alternatives. Travel time can be expressed in terms of total travel time, or by considering separately some parts of the total time, like in-vehicle time, waiting time, access/egress time, parking time, and so on; travel cost represents the monetary cost linked to the transport mode.

According to this approach, a useful way to calculate the value of time is to find the marginal rate of substitution (i.e. the trade-off) between perceived travel times and costs at constant utility. For the linear-in-parameters specification of the utility function, the value of time corresponds to the ratio between the estimated parameters of time and cost attributes. The subjective values of time are heavily dependent on the model specification and data (Gaudry et alii 1989).

As is well-known, the maximum likelihood estimation method used for the calibration of Logit models provides asymptotically distributed multivariate normal parameters (Ben-Akiva and Lerman, 1985). The probability distribution for the ratio between two normally distributed variables is unknown *a priori*, and therefore the value of time is a random variable with an unknown probability distribution function. This circumstance does not allow an easy definition of confidence intervals for the estimated value of time. To this purpose, in the last few years, a number of works have focused on this subject and several methods for constructing confidence intervals of the value of time were proposed. Ettema et alii (1997) discussed a general method based on multivariate normal simulation, while Yadlin, as reported in Armstrong et alii (2001), constructed confidence intervals assuming that a continuous function of normal variates follows a normal probability distribution function. Re-sampling methods were also adopted; in this case, numerous sub-samples are generated by an original sample or artificially created, and models are estimated for each one of them by using the same model specification. In this way, a large number of average values of time are obtained allowing an approximation of its probability distribution. Thus, the limits of the confidence interval are computed by determining the values that correspond to pre-specified percentiles (Armstrong et alii, 2001). The Jackknife and Bootstrap techniques

(Shao and Tu, 1995) are widely used in practice. More recently, Ortùzar introduced other two methods (Armstrong et alii, 2001). The first one, founded on the likelihood ratio test, is based on imposing a linear restriction to the maximum likelihood estimation process and comparing the statistical efficiency of the estimation with respect to the unrestricted case. The procedure consists in searching for values of time for which the linear restriction is valid, given a certain significance level. The second one is based on the asymptotic t-test, generally used in order to prove whether a normally distributed parameter is significantly different from zero. Ben-Akiva and Lerman (1985) proposed an extension of this test for a linear combination of the parameters. As the parameters are asymptotically distributed normal, the following null hypothesis can be postulated:

$$H_0 : \beta_t - VT \cdot \beta_c = 0 \qquad (1)$$

where, β_t is the *time coefficient*, β_c is the *cost coefficient*, and VT represents the *value of time estimate*. The confidence interval is given by the set of VT values for which it is not possible to reject H_0 at a given level of significance. The corresponding test statistics is (Garrido and Ortùzar, 1993):

$$t = \frac{\beta_t - VT \cdot \beta_c}{\sqrt{\mathrm{var}(\beta_t - VT \cdot \beta_c)}} \qquad (2)$$

This expression distributes normal for linear models and asymptotically normal for non-linear models, like Logit models.

On the basis of these assumptions, Garrido and Ortùzar (1993) derived the upper and lower bounds for the confidence interval as follows:

$$V_{L,U} = \left(\frac{\beta_t}{\beta_c}\frac{t_c}{t_t}\right) \cdot \frac{(t_t t_c - \rho \cdot t_{cr}^2)}{(t_c^2 - t_t^2)} \pm \left(\frac{\beta_t}{\beta_c}\frac{t_c}{t_t}\right) \cdot \frac{\sqrt{(\rho \cdot t_{cr}^2 - t_t t_c)^2 - (t_t^2 - t_{cr}^2) \cdot (t_c^2 - t_{cr}^2)}}{(t_c^2 - t_{cr}^2)} \qquad (3)$$

where t_t and t_c correspond to the t-statistics for β_t and β_c respectively; t_{cr} is the critical value of t statistics given the degree of confidence required and the sample size, and ρ is the coefficient of correlation between both parameter estimates.

These approaches were also extended in order to construct confidence intervals for the largest WTP concept. As an example, some authors have recently proposed willingness-to-pay measures derived by discrete mode choice models and have calculated confidence intervals for WTP estimated values (see Greene et alii, 2006; Espino et alii, 2006b).

The construction of the confidence intervals provides the range of possible benefits derived from a given project (Espino et alii, 2006b). Specifically, WTP confidence intervals allow planners to consider the lower and upper limits of the benefits obtained, for example, from travel time savings or service quality improvements in terms of frequency, reliability, comfort, and so on.

3. Discrete choice logit models

Logit models are the better-known discrete choice models. These models are based on the Random Utility Theory (RUT), and on the hypothesis that the errors in the utility function are distributed according to the type I extreme-value (EV1) distribution.

Multinomial Logit (MNL) is the model with the simplest structure inside the Logit family. There are three fundamental hypotheses that underlie the MNL formulation. The first one is that the random components of the utilities of the alternatives are independent and identically distributed (IID). The second one is that the MNL model maintains homogeneity in responsiveness to the attributes of the alternatives across individuals. Finally, the third hypothesis is that the error variance-covariance structure of the alternatives is identical across individuals (Bhat, 2003).

In the last few years, by relaxing the hypotheses of the MNL model, more complex model formulations have been derived, like Heteroskedastic Extreme Value (HEV) models, Generalized Extreme Value (GEV) class of models, and Mixed Logit (ML). Specifically, the ML models have more recently been used in order to consider the heterogeneity among users and permit the differences in user perceptions and responses to be considered. Traditionally, these differences were taken into account by introducing some socioeconomic characteristics of the users among the model attributes. Mixed Logit models spread at the end of the nineties (McFadden and Train, 1997; Bhat, 1998; Train, 1998) as a consequence of the development of specific software for their calibration. ML models can be formulated according to two different structures: “error component structure” and “random coefficients structure” (reported in the literature also as Random Parameter Logit, RPL). In the first structure some hypotheses of correlation between alternatives are made; in the second one some hypotheses of unobserved heterogeneity among users as regards observed variables are made (Bhat, 2003). RPL has the standard form of an MNL model except that one or more parameters can be considered as random parameters, with the standard deviation estimated together with the mean.

For a more exhaustive discussion about Logit models one could refer to Domencich and McFadden (1975), Ben-Akiva and Lerman (1985), Ortuzar and Willumsen (1994), Cascetta (2001), Train (2003).

In this research some Logit models were specified and calibrated in order to calculate users willingness-to-pay for improving service quality. In addition to an MNL, an RPL model was introduced in order to allow the heterogeneity of customers with respect to the service quality responsiveness to be investigated.

4. Empirical application

4.1. Experimental context

A sample survey of the University of Calabria students was conducted. The University is like an Anglo-Saxon campus and is situated in the urban area of Cosenza (in the South of Italy); it is attended by approximately 32,000 students and 2,000 members of staff (March 2006). At the present time, the University is served by bus services connecting the urban area with the campus; extra-urban bus services connect the campus with the other towns of Calabria. The urban bus service is available from 7.30 to 00.30; service frequency is 1 run every 60 minutes. The cost of one-way ticket is 0.77 Euros, while one-day travel card costs 1.55 Euros; in addition, weekly and monthly travel cards are available with a special price for students; the cost of a weekly travel card is about 7 Euros, while a monthly travel card costs about 18 Euros. On a working day, about 8,000 students travel by urban bus.

The survey, realized in the winter of 2006, involved a sample of 470 students who live in the urban area and habitually use the bus to reach the campus. Therefore, the sampling rate is approximately equal to 5.8%. Respondents were asked to provide information about their trip habits regarding getting to the university and, in addition, about public transport service quality.

The interview is divided into three sections: in the first and second section some information about socioeconomic characteristics (gender, age, income and car availability) and travel habits was elicited; the last section of the interview includes an SP experiment proposed to the users, in which they made a choice between the current bus service and two hypothetical bus services. The current service is defined by the user taking into account the bus service used at the time of the interview according to the attribute levels reported in table 1. The alternatives are defined by nine attributes varying on two levels. Each SP alternative is a combination of the attribute levels and represents a bus service. Some levels used in the SP alternatives are not available for the current service. Table 1 reports the attribute levels. The full factorial design includes all the possible combinations among the attribute levels. In this case, it consists of 2^9 combinations producing 512 alternatives. We restricted the number of alternatives to 50 by adopting the usual partialization techniques of the full factorial design.

Only three alternatives were proposed to the users because they may have some difficulties in making a choice between more than three alternatives when several attributes define the alternatives (see for example Prioni and Hensher, 2000; Hensher and Prioni, 2002); in this cases the matter of interviewee's fatigue and burden occurs.

Table 1: Service quality attributes and levels.

Service quality attributes	*Levels*
Walking distance to the bus stop	same as now (1); 10 minutes more (0)
Frequency	every 15 minutes (1); same as now (0)
Reliability	on time (1); late (0)
Bus stop facilities	bus shelter, seats and lighting (1) no shelter, no seats, no lighting (0)
Bus crowding	no overcrowded (1); overcrowded (0)
Cleanliness	clean enough (1); not clean enough (0)
Fare	25% more than the current fare (1); same as now (0)
Information	timetable, map, announcement of delays (1) no timetable, no map, no announcement of delays (0)
Transit personnel attitude	very friendly (1); very unfriendly (0)

The hypothetical alternatives were coupled producing several types of experiments, each of which was proposed to a group of users. The alternatives were coupled by using an empirical simulation procedure. An example of experiment is shown in table 2. To some users two SP experiments were proposed generating 640 observations. In these cases only an SP alternative was replaced in the second experiment in order to reduce the fatigue effect in the respondent.

The sample is spread over 46% male and 54% female respondents. 89% of the student sample was between 18 and 24 years old. The sample was divided, also, in "in course", and "out course" students; in Italy, the "out course" condition relates to a university student who has not finished his studies in the prescribed time. The "in course" students represent a percentage of 78% of the total. About 50% of students belong to a middle class of family income and about 35% to a lower-middle class. Almost all the students do not have the possibility of using a car to reach the campus (92%).

Table 2 - Example of an SP experiment proposed to the interviewed

Attributes	*Current service*	*Service bus A*	*Service bus B*
Walking distance to the bus stop	same as now	10 minutes more	same as now
Frequency	same as now	same as now	every 15 minutes
Reliability	on time	late	late
Bus stop facilities	no shelter, no seats, no lighting	Bus shelter, seats and lighting	no shelter, no seats, no lighting
Bus crowding	overcrowded	overcrowded	no overcrowded
Cleanliness	clean enough	clean enough	not clean enough
Fare	same as now	same as now	25% more than the current fare
Information	no timetable, no map, no announcement of delays	timetable, map, announcement of delays	no timetable, no map, no announcement of delays
Transit personnel attitude	very friendly	very friendly	very unfriendly

4.2. Experimental results

An MNL and an ML model were calibrated by using AMLET package. The package is based on a procedure which uses Monte Carlo sampling to produce the approximate likelihood function and dynamically adapts the number of draws on the basis of statistical estimators of the simulation error and simulation bias (Bastin et alii, 2006).

All the service quality attributes are defined as dichotomous variables, except "Walking distance to the bus stop" and "Ticket cost" that are continuous, measured in minutes and in Euros respectively. Specifically, when people use daily, weekly or monthly cards, the cost was divided by 2, 6, and 24, respectively. The values of the dichotomous variables are defined like the attribute levels reported in table 1. Two socioeconomic characteristics are included in the utility function of the alternative representing the current service: gender (a dummy variable equal to 1 if the student is female and 0 otherwise) and car availability (a dummy variable equal to 1 if the student does not have the possibility of using a car to reach the campus and 0 otherwise); other socio-economic variables were introduced in the model but were not statistically significant.

Specifically, in the ML model, 4 random parameters distributed with a normal distribution and the remaining as fixed parameters were considered. The random parameters are "Reliability of buses that come on schedule", "Bus overcrowding", "Information at bus stops" and "Helpfulness of personnel". Some ML models were specified and calibrated in which the other attributes were considered random. In this paper the model characterised by the best results is described. In table 3 the results of the ML compared to the MNL model results are shown.

Some measures of overall model fit were effected. The Rho squared corrected statistic of the ML model has a value superior (0.334) to the MNL model (0.326). The final values of Log-Likelihood of both models are comparable. An LR statistic for verifying the hypothesis that all the parameters are significantly different from zero was effected; for both models it is notably higher than the critical value. Another LR statistic was effected to compare the ML with the MNL model; the value of this statistic (14.81) confirmed that the ML is statistically better than the MNL model.

All parameters have a correct sign. Both the mean and the standard deviation of the random parameters assume a value statistically different from zero, at a 95% level of significance; also the fixed parameters are significant, except for the "Gender" variable, which have a t-statistic equal to 1.8.

Socio-economic variables assume a positive sign; this result indicates that the utility of the current service has a higher value, ceteris paribus, for the students of female gender and for the students who do not have car availability. These categories of students are more satisfied with the current bus service.

In table 4 the WTP values and their confidence intervals are reported. The confidence interval limits (lower and upper) were calculated by using the method proposed by Garrido and Ortùzar (1993). All the WTP values have a negative sign, except for the walking distance to the bus stop; in this last case, in fact, WTP represents the willingness to pay for reducing the time spent to reach the bus stop, while all the other WTPs represent the willingness to pay for an improvement in the various service aspects from a lower level to an upper one.

The maximum value of WTP concerns service frequency, the minimum one information at bus stops. WTP for an improvement in service frequency is 2 times higher than WTP for improving service reliability, 3 times higher than WTP for improving cleanliness on board, and 5 times higher than the other WTP values.

In the following, only the WTP values obtained from the ML model are discussed; analogous considerations can be effected for the MNL basic model. Currently, the service is available for 17 hours in a day, therefore there are 17 runs/day. Instead, a service frequency of 1 bus every 15 minutes corresponds to 68 runs/day. The obtained WTP value suggests that users would pay 22.8 Euros in order to have 68 runs/day, that is 0.34 Euros per run. This means that users would pay an increase of the ticket equal to 44%, and therefore a ticket cost of 1.1 Euros/run. Analogously, users would pay more expensive weekly and monthly cards (about 10 Euros/week and 26 Euros/month) for an increase in service frequency. The travel expenses in one year would be equal to 312 Euros against the current annual cost of 216 Euros, with an additional travel cost of 96 Euros/year.

Table 3 - ML and MNL model results (in bracket the t-statistics are reported)

variable		*estimation*	
name	*parameter*	*MNL*	*ML*
Walking distance to the bus stop	mean	-0.101 (-4.3)	-0.207 (-7.6)
Service frequency	mean	2.678 (11.5)	4.424 (7.1)
Reliability of buses that come on schedule	mean	1.202 (7.6)	2.370 (7.1)
	st. deviation	-	1.090 (3.1)
Availability of furniture at bus stops	mean	0.583 (3.8)	0.952 (3.6)
Bus overcrowding	mean	0.643 (3.4)	1.138 (3.6)
	st. deviation	-	1.980 (2.9)
Cleanliness of interior, seats and windows	mean	0.741 (5.0)	1.390 (4.9)
Ticket cost	mean	-5.451 (-4.2)	-11.617 (-7.2)
Information at bus stops	mean	0.561 (3.6)	0.936 (3.6)
	st. deviation	-	1.533 (2.2)
Helpfulness of personnel	mean	0.451 (3.1)	0.981 (3.9)
	st. deviation	-	2.496 (4.5)
Gender	mean	0.328 (1.8)	-
Car availability	mean	0.422 (2.0)	-
Final value of Log-Likelihood		-462.860	-455.453
Log-Likelihood with Zero coefficients		-703.112	-703.112
Rho squared		0.342	0.352
Rho squared corrected		0.326	0.334
Likelihood Ratio		480.504 (χ^2=19.675)	495.318 (χ^2=22.362)

Analogous calculations can be effected by considering the other WTP values. The only exception is for the WTP for reducing the walking time to the bus stop because this value is expressed in Euros/h and it refers to a single run. By considering the average walking distance (in terms of time) occurred in the sample (3 minutes and 43 seconds), a WTP value of 0.07 Euros/run was obtained; therefore, users would pay a ticket cost of 0.84 Euros/run, a weekly card of about 7.50 Euros and a monthly card of about 20 Euros. The travel expenses in one year would be equal to 240 Euros, with an additional travel cost of 24 Euros/year.

By referring to the global service, the users are willing to pay an increase of about 1 Euro/run for an improvement in all the service aspects considered in the SP experiment. This means that a ticket could cost 1.8 Euros/run, a weekly card about 16 Euros and a monthly card about 40 Euros. Obviously, these values were obtained by considering the WTP values referred to 68 runs/day. By considering the estimated WTP confidence intervals the ticket cost varies from a lower value of 1.5 Euros/run to an upper of 2 Euros/run, the weekly card from 13 to 19 Euros, and the monthly card from 34 to 50 Euros.

Table 4 - WTP calculation

variable	*MNL*		*ML*	
	WTP	Confidence interval	WTP	Confidence interval
Walking distance to the bus stop	1.112	0.773 to 1.620	1.069	0.914 to 1.260
Service frequency	-29.477	-53.152 to -20.292	-22.849	-28.067 to -18.559
Reliability of buses that come on schedule	-13.231	-24.349 to -8.579	-12.241	-15.812 to -9.455
Availability of furniture at bus stops	-6.417	-12.655 to -3.053	-4.917	-7.266 to -2.528
Bus overcrowding	-7.078	-14.094 to -3.034	-5.878	-9.291 to -2.825
Cleanliness of interior, seats and windows	-8.156	-15.895 to -4.528	-7.179	-10.329 to -4.527
Information at bus stops	-6.175	-13.183 to -2.602	-4.834	-7.327 to -2.424
Helpfulness of personnel	-4.964	-10.642 to -1.777	-5.067	-8.115 to -2.554

The travel expenses in one year could be equal to 480 Euros, with an additional travel cost of 264 Euros/year. By considering the estimated WTP confidence intervals the potential annual travel expense varies from a lower value of 408 to an upper value of 600 Euros.

These amounts are quite considerable if compared to the total travelling passengers. As an example, by considering a number of 8,000 habitual bus passengers, transit operators could have an additional amount of about 2 million Euros to invest for improving the current bus service.

5. Conclusions

The main purpose of this research is to provide a tool for calculating user willingness-to-pay for improving service quality in public transport. To this purpose some MNL and ML models were calibrated on the basis of the user choices made in SP experimental contexts. Specifically, the ML model allowed investigation on the heterogeneity across individuals about some service quality attributes. The heterogeneity about the perceptions of “Reliability”, “Bus overcrowding”, “Information at bus stops”, and “Helpfulness of personnel” attributes was investigated. The standard deviation values obtained from the model calibration suggest that there is a notable difference in user perception of these attributes.

The willingness-to-pay in terms of service quality attributes represents a quantitative measure of the monetary cost that the user would pay for improving some qualitative service aspects, such as comfort and safety during the journey. These service aspects are generally neglected because of the difficulty of their evaluation and quantification in monetary terms. WTP values may be used for calculating the project revenues in transport service investments. As an example, in the analysed experimental context, an increase of 22% of the amounts derived from the monthly cards was calculated from the estimated WTP values.

In order to take into account the randomness of the estimated WTP, the limits (lower and upper) of the confidence intervals were calculated by using the method proposed by Garrido and Ortùzar (1993). The confidence interval calculation provides a sensitivity analysis of the possible investments that a transit operator can make starting from the amounts the users are willing to spend for improving service quality.

A limitation of the adopted methodology is linked to the estimation both of WTP values and their confidence intervals. In fact, the obtained values vary strongly with the model specification because of the strong dependence of the WTP values on the functional form assumed for the utility function of the alternatives, and on the model structure.

References

Armstrong, P., Garrido, R. and Ortùzar, J. de D. (2001) "Confidence intervals to bound the value of time." Transportation Research Part E, 37, pp.143-161.

Bastin, F., Cirillo, C. and Toint, P.L. (2006) "Application of an adaptive Monte Carlo algorithm to mixed logit estimation." Trasportation Research Part B, 40, pp.577-593.

Ben-Akiva, M.E. and Lerman, S.R. (1985) Dicrete Choice Analysis: Theory and Application to Travel Demand, The MIT Press, Cambridge, Mass.

Bhat, C.R. (1998) "Accommodating variations in responsiveness to level-of-service measures in travel mode choice modeling." Transportation Research Part A, 32, pp.495-507.

Bhat, C.R. (2003) "Random Utility-Based Discrete Choice Models for Travel Demand analysis", In: K.G. Goulias (ed.) Transportation systems planning, pp.(10)1-(10)29 CRC Press, Washington, D.C.

Bjorner, T.B. (2004) "Combining socio-acoustic and contingent valuation surveys to value noise reduction." Transportation Research Part D, 9, pp.341-356.

Brownstone, D., Ghosh, A., Golob, T.S., Kazimi, C. and Van Ameslsfort, D. (2003) "Drivers' willingness-to-pay to reduce travel time: evidence from the San Diego I-15 congestion pricing project." Transportation Research Part A, 37, pp.373-387.

Cascetta, E. (2001) Transportation Systems Engineering: Theory and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Denant-Boèmont, L. and Petiot, R. (2003) "Information value and sequential decision-making in a transport setting: an experimental study." Transportation Research Part B, 37, pp.365-386.

Domencich, T.A. and McFadden, D. (1975) Urban Travel Demand: a Behavioural Analysis. American Elsevier, New York.

Espino, R., Ortùzar, J. de D. and Romàn, C. (2006a) "Analysing demand for suburban trips: A mixed RP/SP model with latent variables and interaction effects." Transportation, 33, pp.241-261.

Espino, R., Ortùzar, J. de D. and Romàn, C. (2006b) "Confidence Interval for Willingness to Pay Measures in Mode Choice Models." Networks and Spatial Economics, 6, pp.81-96.

Ettema, D., Gunn, H., De Jong, G. and Lindveld, K. (1997) "A simulation method for determining the confidence interval of a weighted group average value of time", Proceedings of the 25th European Transport Forum, Brunel University, England.

Feitelson, E., Hurd, R.E. and Mudge R.R (1996) "The impact of airport noise on willingness to pay of residences." Transportation Research Part D, 1(1), pp.1-14.

Fosgerau, M. and Bjorner, T.B. (2006) "Joint models for noise annoyance and willingness to pay for road noise reduction." Transportation Research Part B, 40, pp.164-178.

Freeman, A.M. (2003). The Measurement of Environmental and Resource Values: Theory and Methods. Resources for the Future, Washington, DC.

Garrido, R.A. and Ortùzar, J. de D. (1993) "The Chilean value of time study: methodological developments", Proceedings of the 21st PTRC Summer Annual Meeting, University of Manchester Institute of Science and Technology, England.

Garrod, G., Willis, K.G. (1999). Economic Valuation of the Environment: Methods and Case Studies. Edward Elgar, Cheltenham, UK.

Gaudry, M.J.I., Jara-Diaz, S.R. and Ortùzar, J. de D. (1989). "Value of time sensitivity to model specification." Transportation Research Part B, 23(2), pp.151-8.

Greene, W.H., Hensher, D.A. and Rose, J. (2006) "Accounting for heterogeneity in the variance of unobserved effects in mixed logit models." Transportation Research Part B, 40, pp.75-92.

Hensher, D.A. and Goodwin, P. (2004) "Using values of travel time savings for toll roads: avoiding some common errors." Transport Policy, 11, pp.171-181.

Hensher, D.A. (2006a) "The signs of the times: Imposing a globally signed condition on willingness to pay distributions." Transportation, 33, pp.205-222.

Hensher, D.A. (2006b) "Towards a practical method to establish comparable values of travel time savings from stated choice experiments with differing design dimensions." Transportation Research Part A, 40, pp.829-840.

Hensher, D.A. (2001) "Service quality as a package: what does it mean to heterogeneous consumers?", Proceedings of 9th World Conference on Transport Research, pp.22-27 July, Seoul, Korea.

Hensher, D.A. and Prioni, P. (2002) "A service quality index for area-wide contract performance assessment regime." Journal of Transport Economics and Policy, 36(1), pp.93-113.

Hensher, D.A., Stopper, P. and Bullock, P. (2003) "Service quality-developing a service quality index in the provision of commercial bus contracts." Transportation Research Part A, 37, pp.499-517.

Iraguen, P. and Ortùzar, J. de D. (2004). "Willingness-to-pay for reducing fatal accident risk in urban areas: an Internet-based Web page stated preference survey." Accident Analysis and Prevention, 36 (4), pp.513-524.

Jim, C.Y., Chen, W.Y. (2007) "Consumption preferences and environmental externalities: A hedonic analysis of the housing market in Guangzhou." Geoforum, 38, pp.414-431.

Jorgensen, F. and Dargay, J. (2007) "Inferring price elasticities of car use and moral costs of driving without a licence." Transportation Research Part A, 41, pp.49-55.

Jorgensen, F. and Wentzel-Larsen, T. (2002) "Car drivers' willingness to pay for not losing their driving licence." Transportation, 29, pp.271-286.

Khattak, A.J., Yim, Y., Stalker Prokopy, L. (2003) "Willingness to pay for travel information." Transportation Research Part C, 11, pp.137-159.

McFadden, D. and Train, K. (1997). Mixed Multinomial Logit Models for Discrete Response, working paper, Department of Economics, University of California, Berkeley.

MacFadden, D. (1997) Measuring willingness-to-pay for transportation improvements. University of California, Berkeley.

Mehndiratta, S., Kemp, M. Peirce, S. and Lappin J. (2000) "Users of a regional telephone-based traveler information system - a study of TravInfoTM users in the San Francisco Bay Area." Transportation, 27, pp.391-417.

Molin, E.J.E. and Timmermanns, H.J.P. (2006) "Traveler expectations and willingness-to-pay for Web-enabled public transport information services." Transportation Research Part C, 14, pp.57-67.

Ortùzar, J. de D. and Rodrìguez, G. (2002) "Valuing reductions in environmental pollution in a residential location context." Transportation Research Part D, 7, pp.407-427.

Ortùzar, J. de D. and Willumsen, L.G. (1994) Modelling Transport. John Wiley and Sons Ltd, England.

Pearmain, D., Swanson, J., Bradley M. and Kroes, E. (1991) Stated Preference Techniques: A Guide to Practice. Second Edition, Steer Davies Gleave and Hague Consulting Group.

Prioni, P. and Hensher, D.A. (2000) "Measuring service quality in scheduled bus services." Journal of Public Transportation, 3(2), pp.51-74.

Ramanayya, V. and Nagadevara, S.R. (2007) "Quality Expectations of Transport Services and Willingness to Pay: Case of KSRTC." AIMS International, 1(1), pp.39-52.

Rizzi, L.I. and Ortùzar, J. de D. (2003). "Stated preference in the valuation of interurban road safety." Accident Analysis and Prevention, 35 (1), pp.9-22.

Saelensminde, K. (1999) "Stated choice valuation of urban traffic air pollution and noise." Transportation Research Part D, 4, pp.13-27.

Shao, J. and Tu, D. (1995) The Jackknife and the Bootstrap. Springer, New York.

Train, K.E. (2003) Discrete Choice Methods with Simulation. Cambridge University Press, Cambridge.

Train, K.E. (1998) "Recreation Demand Models with Taste Differences over People." Land Economics, 74, pp.230-239.

Walton, D., Thomas, G.A. and Cenek, P.D. (2004) "Self and others' willingness to pay for improvements to the paved road surface." Transportation Research Part A, 38, pp.483-494.