Organisational forms

- Authority initiative
  - 'Concessions'
  - Management contract
  - Own management
  - (Dominated by public companies)

- Market initiative
  - 'Authorisations'
  - Open entry
  - (Dominated by private companies)

MARETOPE Handbook

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- NEA, Transport Research and Training  NL
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- HGL, Halcrow Group Limited  UK
- TOI, Institute of Transport Economics  NO
- LT Consultants, Ltd.  FIN
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- TRANSTEC – Consult, TransTec Transport und Technologie Consult Hannover GmbH  D
- HVV, Hamburger Verkehrsverbund GmbH  D
- FGM-AMOR, Forschungsgesellschaft Mobilität  A
- INFRAS  CH
- ENPC, École Nationale des Ponts et Chaussées  F
- TRANSMAN, Transman Consulting for Transport System Management Ltd  HU

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MARETOPE Handbook

FOREWORD

This is the final report of a RESEARCH project, carried out at European (EU+ Norway + Hungary + Switzerland) level, and not a consultancy project aimed at a specific set of clients. Its recommendations should thus be realistic but, given its universal character, must not be interpreted as directly applicable to any specific case.

Over this report, the reader will be invited to undertake the analysis of its own situation and based on the results obtained promote a reflection on the need to change the legal and regulatory framework. This means that in this report the pros and cons of each alternative setting will be highlighted, as a synthesis result of the research but no recommendations are made in relation to the choice of any specific path as, from the outset, this is considered a decision of political domain.
Table of contents

FOREWORD ............................................................................................................................................................... 1

EXECUTIVE SUMMARY ........................................................................................................................................... 5

1. INTRODUCTION TO MARETOPE HANDBOOK ................................................................................................. 10
   1.1. MARETOPE RESEARCH ............................................................................................................................ 10
   1.2. MARETOPE PARTNERSHIP ....................................................................................................................... 19

2. REFERENCE FRAMEWORK ................................................................................................................................. 21
   2.1. KEY QUESTIONS WITHIN THE REFERENCE FRAMEWORK ..................................................................... 21
   2.2. REGULATORY CHANGES AT NATIONAL AND LOCAL LEVELS ................................................................. 31
       2.2.1. Impacts .................................................................................................................................................. 39
       2.2.2. Barriers & Tools ................................................................................................................................... 42
   3. SELF ASSESSMENT FOR DECISIONS ON CHANGE PATH ............................................................................. 51

4. IMPLEMENT AND MANAGE CHANGE .............................................................................................................. 61
   4.1. KEY ISSUES TO MANAGE THE CHANGE PROCESS ................................................................................. 61

5. CONCLUSIONS & RECOMMENDATIONS FROM MARETOPE RESEARCH ........................................................ 78
   5.1. RESEARCH ISSUES ...................................................................................................................................... 78
   5.2. IMPACT ANALYSIS .................................................................................................................................... 79
   5.3. RECOMMENDATIONS ................................................................................................................................. 83
       5.3.1. Performance analysis ............................................................................................................................ 83
       5.3.2. Improvements ....................................................................................................................................... 84
   5.4. BARRIERS & TOOLS .................................................................................................................................. 86
       5.4.1. Barrier environment ............................................................................................................................. 86
       5.4.2. Development of tools to enhance the urban transport regulation ......................................................... 94

6. BIBLIOGRAPHIC REFERENCES ......................................................................................................................... 102

ANNEX 1 – GUIDELINES FOR IMPACT ASSESSMENT FOR REGULATORY REFORM ............................................. 112

   INDICATOR CATALOGUE .................................................................................................................................... 117

   Key Performance Indicators (KPIs) current data ..................................................................................................... 117
   Key Performance Indicators (KPIs) with Ideal Data .............................................................................................. 152

ANNEX 2: GLOSSARY .................................................................................................................................................. 172

ANNEX 3 – KEY PERFORMANCE INDICATORS IN MARETOPE CASE STUDIES ..................................................... 181
### Table of figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>MARETOPE General Approach</td>
<td>13</td>
</tr>
<tr>
<td>Figure 2</td>
<td>MARETOPE Research</td>
<td>14</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Conceptual Simplified Representation of Stakeholders’ Relationships</td>
<td>22</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Organisational Forms in Public Transport</td>
<td>23</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Continuum of Organisational Forms</td>
<td>24</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Levels of Planning and Control in Public Transport</td>
<td>26</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Structuring the Change Process</td>
<td>36</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Evolution in Organisational Forms</td>
<td>37</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Theoretical Evolutionary Patterns (Simplified Version)</td>
<td>38</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Self Assessment Process</td>
<td>51</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Barrier Life Cycle</td>
<td>62</td>
</tr>
<tr>
<td>Figure 12</td>
<td>Boomerang Effect of Barriers and Tools</td>
<td>63</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Sequence of Barriers</td>
<td>68</td>
</tr>
<tr>
<td>Figure 14</td>
<td>Set of Barriers</td>
<td>68</td>
</tr>
<tr>
<td>Figure 15</td>
<td>Resistance Developing Process</td>
<td>70</td>
</tr>
<tr>
<td>Figure 16</td>
<td>First Possibility of an Overall Tool</td>
<td>72</td>
</tr>
<tr>
<td>Figure 17</td>
<td>Second Possibility of an Overall Tool</td>
<td>73</td>
</tr>
<tr>
<td>Figure 18</td>
<td>Analytical Framework</td>
<td>112</td>
</tr>
<tr>
<td>Figure 19</td>
<td>An Illustration of DEA Efficiency Analysis (Non-Increasing Returns to Scale)</td>
<td>154</td>
</tr>
</tbody>
</table>

### Table of graphics

<table>
<thead>
<tr>
<th>Graphic</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic 1</td>
<td>Changes in Labour Productivity</td>
<td>40</td>
</tr>
<tr>
<td>Graphic 2</td>
<td>Changes in Service Supply</td>
<td>41</td>
</tr>
<tr>
<td>Graphic 3</td>
<td>Changes in Public Transport Demand</td>
<td>42</td>
</tr>
<tr>
<td>Graphic 4</td>
<td>Barriers by Nature Level</td>
<td>43</td>
</tr>
<tr>
<td>Graphic 5</td>
<td>Tools by Nature Level</td>
<td>44</td>
</tr>
<tr>
<td>Graphic 6</td>
<td>Barriers by Hierarchical Level</td>
<td>45</td>
</tr>
<tr>
<td>Graphic 7</td>
<td>Tools by Hierarchical Level</td>
<td>45</td>
</tr>
<tr>
<td>Graphic 8</td>
<td>Barriers by STO Level</td>
<td>46</td>
</tr>
<tr>
<td>Graphic 9</td>
<td>Tools by STO Level</td>
<td>46</td>
</tr>
<tr>
<td>Graphic 10</td>
<td>Barriers by Stage of Reform Process</td>
<td>47</td>
</tr>
<tr>
<td>Graphic 11</td>
<td>Tools by Stage of Reform Process</td>
<td>47</td>
</tr>
</tbody>
</table>
Table of tables

**TABLE 1** - COUNTRIES GROUPING BY TRANSITION STAGE AND POLITICAL TARGETS .................................................. 35
**TABLE 2** - BARRIERS AND TOOLS ACCORDING TO THE EVOLUTIONARY MODELS ................................................. 50
**TABLE 3** - BARRIERS CHARACTERISTICS AND ENVIRONMENT .......................................................................................... 68
**TABLE 4** - TOOLS CHARACTERISTICS AND ENVIRONMENT .................................................................................................. 71
**TABLE 5** - SPECTRUM OF APPROACHES FOR THE IMPACT ANALYSIS ............................................................................. 83
**TABLE 6** - INTERPRETATION OF JOINT VALUES OF “RELATIVE ACCESSIBILITY” VERSUS “RELATIVE SUPPLY” .......... 161
EXECUTIVE SUMMARY

MARETOPE’s mission was “to investigate in an integrated way the impacts of change in the legal and organisational local public transport framework”. The research included the provision of an updated view of the different forms that countries and cities have adopted to handle the implementation of strategic decisions, the evolutionary stages of their legal and organisational settings, focusing as well as on the need to improve performance of public transport.

The research was organised along a logical sequence starting from the analysis of the factors influencing the regulatory change (country and case studies surveys), assessment of the impacts of change in the performance levels towards the evaluation of barriers and identification of tools to facilitate the change. The final output of MARETOPE consisted in the production of the current handbook with guidelines addressing the most adequate tools to manage and assess the regulatory evolution.

Despite the strong objectives established for the project from the outset some difficulties had been present. A major pitfall in undertaking the research was undoubtedly the limited number of cases in which sufficient time lag had passed after the implementation of the reform that could allow a measurement of full extent of impacts. Although the main criteria underlying the selection of case studies was the existence of a change process with possibilities to assess performance levels before, during and after the reform, with the exception of the UK and some Scandinavian cases the process of change is still occurring, a fact that turned out to make the analysis more difficult.

Within this report the following main questions were addressed:

- How are cities evolving? What are the main issues in discussion?
- How can we detect the need for a legal and regulatory framework change?
- How to evaluate the change alternatives?
- How should authorities organise processes, while assuring performance levels during transition period?
- How can we monitor and adapt the mobility system to meet the citizens’ needs?

The last years have witnessed in a number of European countries significant changes in the organisational frameworks of local public transport in order to ensure the improvement in transparency, economic efficiency and quality of service. This development is being promoted by the European Commission through the provision of an appropriate legal framework at the European level.
These developments confirm the importance of the efficiency concept, both in the production and in consumption of local transport systems as one of the main building blocks for sustainable growth and employment in Europe, as well as to contribute to economic and social cohesion for which local transport services play a determinant role by being safe, affordable, easily available and reliable, and last but not least delivering a quality that fulfils citizens needs and expectations. However, independently on the regulatory regime in force, the success of these developments depends very much on the effectiveness of the relationship between authorities and operators.

Background studies revealed that productive efficiency pressure was more effectively applied through tendering procedures, with authorities taking the role of the entrepreneur, but experience reveals also that a deeper involvement of operators is needed to cope with a “new mission” of public transport in the improvement of urban living conditions. A general movement from gross to net cost contracts could also be observed.

The research highlighted that the main driving force for change in most European countries and cities was of financial nature: the cost coverage of public transport was regarded to be too low and the amounts of money involved through subsidies too high. Additional driving forces observed concern the improvements towards more transparent, effective and quality UPT services. More precise the driving forces are:

- The need for a better quality of service in order to meet better the objectives of the Citizen’s Network policy document;
- The need for a more efficient and effective spending of money to reach a positive change in modal split and number of passengers;
- The need to enforce the position of the customer by giving him influence in the organisation of public transport;
- The need to create a proper sustainable financial framework in relation to the use of public funds;
- the foreseen European regulations on land transport.

In terms of the performance analysis the following dimensions have been analysed: labour productivity, cost performance, technical efficiency, service supply, market effectiveness and economic welfare. In addition, an overall assessment of individual case studies has been undertaken. Although the results are exploratory (in the sense that they refer specifically to the selected case studies) some interesting findings have been obtained such as:

- Labour productivity: results seem to indicate that public ownership has a negative effect whereas existence of competition has a positive effect. These results hold both with respect to local public transport system (LPTS) level and modal level.
- Cost performance: results suggested that cities where operators bear production and/or revenue risks have significant lower unit costs compared to other cities. It was found that public ownership indicated slightly lower costs, while existence of competition indicated slightly higher cost (neither results are statistically significant). These counter intuitive results appear to be caused by the inclusion of some Southern and Eastern European
cities with substantial lower labour costs combined with mostly public ownership and lack of competition in the public transport market. It should be mentioned that these results are found at LPTS level but not for bus only.

- Technical efficiency: results seem to indicate that public ownership has a negative effect whereas cities where operators bear production and/or revenue risks have a higher efficiency compared to other cities.
- Service supply: the results suggest that cities with publicly owned operators and/or tendering have a higher level of service density (measured as mln vehicle kilometres per km$^2$) compared to other cities.
- Market effectiveness: the estimated demand model provides a good explanation of public transport demand through inclusion of standard explanatory factors such as fare, average per capita income and service level. However, the estimated model does not specifically include variables concerning organisational or regulatory variables, as none of them are significant. This implies that their influence is more indirect working through the included explanatory variables, e.g. regulatory and organisational factors could have an influence on both service level and fare levels.
- Economic welfare: the findings suggest that small and medium cities generally perform better in terms of consumer surplus per capita, producer surplus per vehicle kilometre and welfare per capita. Overall assessment: results suggest that cities that have introduced competitive tendering have the largest positive increase in public transport efficiency. This is likely to be partly linked to the reduction in number of employees often occurring when regulatory reforms are introduced, although the social cost of unemployment is not taken into account. At this stage, we can conclude that competitive tendering has a positive influence on efficiency even if its contribution cannot be quantified.

Although these results are far from being clear-cut conclusions concerning the influence of regulatory factors (e.g. public vs. private ownership, competition vs. no competition), they do provide some indications which can be the starting point for more detailed analysis within each case study city. This highlights an important role of performance analysis to be used as a dialogue instrument for individual cities to re-assess the organisation of local public transport services.

Throughout the research a detailed assessment of barriers and tools was undertaken. An overall analysis across the case study cities indicates that acceptability and impacts perceived are strongly related to the type of reform being implemented/discussed, although it is not possible to provide exhaustive conclusions about the three types of reform (only organisational reform, organisational reform and introduction of a degree of competition and introduction of a degree of competition). This limitation is mainly due to the existence of other impacts, which can not be isolated. However, a key concern (barrier) across the case studies are the implications of introducing competition. It seems that in general, stakeholders are more concerned about reforms involving more competition than with organisational reforms. However, some cases (e.g. Oxford) suggest that it is possible to establish a system with tendering and open
entry without some of the negative impacts perceived by the different stakeholders, if mitigating measures are adopted in advance.

The most frequent barriers and tools according to the respective evolutionary path referred to in the case studies were respectively:

<table>
<thead>
<tr>
<th>Evolutionary Forms of Reforms</th>
<th>Common Barriers and Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Market</td>
<td></td>
</tr>
<tr>
<td>Improvement of quality and efficiency</td>
<td>- B: Some minor obstacles encountered in undertaking internal changes;</td>
</tr>
<tr>
<td></td>
<td>- T: general consensus on satisfaction about present situation</td>
</tr>
<tr>
<td>Coming back to closed market from controlled</td>
<td>- B: Some minor difficulties on legal and regulatory status of the main operator;</td>
</tr>
<tr>
<td>competition</td>
<td>- T: General consensus on considering public owned operator solution as the preferred one</td>
</tr>
<tr>
<td>Organisational reform</td>
<td>- B: Opposition of the stakeholders and financial difficulties;</td>
</tr>
<tr>
<td></td>
<td>- T: Importance of involvement of all players and implementation of some pragmatic solutions as key tools</td>
</tr>
<tr>
<td>Controlled Competition</td>
<td></td>
</tr>
<tr>
<td>One operator</td>
<td>- B: Lack of skills and experience of authorities, not real competitive market;</td>
</tr>
<tr>
<td></td>
<td>- T: Focus on contractual and tendering procedures as well as on institutional restructuring.</td>
</tr>
<tr>
<td>Plurality of operators</td>
<td>- B: Opposition to the new regime, authorities and operators unprepared, not real competitive market, not clear division of roles and financial problems;</td>
</tr>
<tr>
<td></td>
<td>- T: Negotiations with trade unions, increasing skills and experiences of stakeholders and institutional restructuring as important tools.</td>
</tr>
<tr>
<td>From market initiative</td>
<td>- B: Opposition to the competitive market, authorities and operators unprepared, not real competitive market, unclear legal framework and instability of financial resources;</td>
</tr>
<tr>
<td></td>
<td>- T: Negotiations with actors, training programmes, increased competition (for operators), project management, external advisory and support (for authorities), new legal framework, restructuring and privatisation of operators, changes in subsidy and fare policies.</td>
</tr>
<tr>
<td>Deregulation</td>
<td></td>
</tr>
<tr>
<td>Improvement of quality and efficiency</td>
<td>- B: Lack of skills of operators and authorities and influence of authorities;</td>
</tr>
<tr>
<td></td>
<td>- T: Increase regulatory and controls power of the authorities (via quality contracts). Statutory arrangements between operators and authorities via quality partnerships. Reforms of subsidy regime.</td>
</tr>
</tbody>
</table>
The main pitfall from MARETOPE, which have limited the conclusions achieved, is the fact that in the majority of observed cities the change process had only recently started and in some others, had not even been implemented. This causes a considerable lack of maturity in the process itself and consequently effects can not be properly assessed. In particular, the impact analysis has illustrated the problem represented by lack of appropriate data for variables used in the performance analysis.

In MARETOPE this has been taken forward by presenting three broad groups of approaches for each performance dimension considered: an ideal approach, intermediate approaches (mostly the ones used our research) and approaches to be used when data are either missing or poor.

In spite of the need to have some reservation about drawing conclusions at this stage (due to the already mentioned lack of maturity of the process), some considerations on the development of tools to facilitate the adoption of a broader urban transport regulation perspective was carried on.

A basic tool is the so named open co-ordination method, which is recommended to achieve an enhanced institutional and financial co-ordination among the various actors whose actions/decisions influence the performance of the LPT system, and of urban transport at large. Also a process which can be considered as ancillary to achieve mutual understanding and co-ordination among several stakeholders positions is consensus building. This aims at identifying areas of mutual gain, and attempts to construct “win-win” outcomes from the decision-making process.

Other recommendations from research refers to a set of improvements that authorities and operators should undertake in order to create the basic data that will enable the assessment of their performance.
1. **INTRODUCTION TO MARETOPE HANDBOOK**

1.1. **MARETOPE research**

What was MARETOPE about

Urban Public Transport (UPT) in Europe is considered an indispensable element to support economic and social activities in modern cities, and this is probably the main reason why this sector is so politically sensitive and has been subject to State intervention all along its history, mainly through regulation and subsidisation.

European policies aimed at improving efficiency and effectiveness of collective transport forced the in-depth revision of the regulatory and organisational settings of this sector by introducing competitive pressure in the awarding of contracts through tendering, while challenging old established monopolies to re-organise themselves.

Even the changes in structure and dimension of the urban environment itself, added to the congestion phenomenon, the scarcity of public money and, last but not least, a growing awareness of society about environmental problems, are among the main factors that have lead to stronger demands of efficiency in transport systems, and consequently to the use of pricing and competition policies, among the main instruments to achieve that aim.

All these movements of change led to rethink public service concepts and if some decades ago subsidies for public transport found political support today these services are confronted with severe state budget constraints encompassed by a better informed and more demanding set of clients.

The last years have witnessed in a number of European countries significant changes in the legal and organisational frameworks of local public transport in order to ensure an improvement in transparency, economic efficiency and quality of the service. The European Commission promotes this development through the provision of an appropriate legal framework at European level, as originally suggested in the Citizens’ Network Green Paper and later reinforced and clearly indicated in the Communication “Developing the Citizens Network”.

Evidence from several research studies revealed that whatever the regulatory regime in force,
its success strongly depends on the effectiveness of the relationship between authorities and operators. That is, one of the main functional roles of authorities is to induce operators to conduct their business towards the achievement of the strategic goals of the system (i.e. principal-agent theory), for which complementary schemes of incentives and penalties are an indispensable tool.

The relatively poor performance of the local public transport sector in Europe was a major building block at the origin of further reflections on this subject. For example, the sector's share of passenger travel in the 15 member states of the European Union has declined from 24.5% in 1970 to 15.6% in 1999. This decline in market shares and, in many cases, in market volume has often been accompanied by rising fares and falling service levels. This in turn has led to further decreases in public transport patronage – the so-called vicious circle. Given this background, there have been a number of attempts, both at Member State and at the European level, to break out this spiral of decline and move from a vicious to a virtuous circle, largely based on performance improvement and competitive pressure as main driving factors.

At the European level the main milestones of this trend have been for railways, directive 91/440 and the Railways White Paper in 1996, both with a significant impact on suburban transport and, for local public transport, the Citizens' Networks Green Paper in 1995, the Communication “The Common Transport Policy – Sustainable Mobility: Perspectives for the future” and, also in 2000, the “Proposal for an action by Member States concerning public service requirements and the award of the public service contracts in passenger transport by rail, road and inland waterways”, later derived into a proposal for revision of the regulation 1893/91 concerning public service requirements and the award of public service contracts¹.

Despite the subsidiarity principle, there is no doubt that the tackling of theses issues in the policy reflection documents launched by the European Commission, definitely placed the need for reform of the regulatory and organisational frameworks of passenger transport in the Member States agenda and initiated with it the different national policy formation processes for regulatory reform of public transport. Each country has given different contours to the discussion and designed different possible courses of action, this has included reforms leading to deregulated competitive markets (as for buses in Great Britain, outside London) and various forms of competitive tendering (as for local public transport in France and the Nordic

¹ At the stage of writing this report regulation 1893/91 was still in force, with its revision pending for parliament approval
Countries) which have since been progressively changed in a convergent move towards the existence of competitive pressure in the system, while keeping a quality improvement commitment between partners involved, as a major anchor to overcome possible pitfalls accruing from competitive procedures.

All these developments confirm the importance of the efficiency concept, both in the production and in consumption (i.e. efficiency from the users viewpoint), of local transport systems as one of the main building blocks for sustainable growth and employment in Europe, as well as to contribute to economic and social cohesion for which local transport services play a determinant role by being safe, affordable, easily available and reliable, and above all delivering a quality that fulfils citizens needs and expectations.

A number of European research projects², as well as series of developments in national and local policy development processes, were at the origin of the development of the MARETOPE research project which is focused on how to better manage change processes being fostered in the regulatory and organisational settings.

From the outset, MARETOPE’ mission was “to investigate in an integrated way the impacts of change in the legal and organisational local public transport framework”, meaning the provision of an updated view of the different ways countries and cities have adopted to handle the implementation of strategic decisions, regarding the evolutionary stages of their legal and organisational settings, and focusing on the need to improve performance of public transport.

Our approach

To cope with that wide overall objective, MARETOPE project investigated in an integrated way those impacts of changes on the roles and activities of the different stakeholders: public transport operators, public authorities, users and producers of transport means and systems. Furthermore, it was also focused in the identification of barriers that hindered and/or simply delayed the adaptation to change and the development of tools to support decision-makers in that process and in the management of transition periods. Despite the bold objectives established for the research a major pitfall in undertaking it has been the limited number of cases where sufficient time lag was passed over the implementation of reform so that the full extent of impacts caused could be effectively identified and performance assessed before, during and after observed reform processes. This has been a major criteria in the selection of

² Such as ISOTOPE (4\textsuperscript{th} RTD framework), SORT-IT, QUATTRO and Public Service Obligations study to the European Commission.
The final goal of MARETOPE consisted in the production of the current handbook with **guidelines** designed for the different groups of stakeholders addressing the most adequate tools to manage and assess the regulatory evolution taking as departure basis the main change vectors, the legal and organisational setting as well as the relative stage of process development and, in particular a better understanding of the factors influencing change.

![Figure 1 - MARETOPE general approach](image)

**Main building blocks of MARETOPE**

The progress of MARETOPE, following the methodological approach highlighted in the figure 2, was divided in three main stages,

- a first one dedicated to the harmonisation of concepts, state of the art on current stage of regulatory reform in the different countries, data collection on change processes (WP1 and WP2);
- a second one dedicated to the in-depth analysis of impacts, barriers and tools (WP3 and WP4);
- and a third one fully devoted to the production of guidelines and recommendations on change management (WP5).
The research takes as departure point a set of exogenous factors at the origin of the process of regulatory change, which in turn entails reforms undertaken in three different aspects: legal, regulatory, financial.

Then, based on country and urban case studies\(^3\) surveys, the main characteristics of the changing vectors have been identified according to the following issues:

- Which factors are at the root of the different change processes;
- Which regulatory change is at stake;
- Which changing vectors;
- Which stakeholders are affected by the change process;
- Which barriers are raised by the different agents;

The third block of analyses is dedicated to the implementation of the change process, building up of transitional path and roles to be undertaken by each agent, after which the fourth block of analysis is dedicated to the impact of these changes over each stakeholders giving origin to

---

\(^3\) The 31 case studies assessed in the MARETOPE research were respectively: Aarhus, Athens, Barcelona, Bergen, Bern, Budapest, Copenhagen, Dublin, Groningen, Hanover, Helsingborg, Innsbruck, KAN, La Rochelle, Leeds, Lisbon, London, Lyon, Malmö, Munich, Oslo, Oxford, Paris, Poznan, Rome, Stockholm, Sundsvall, The Hague, Trieste, Turku, Vienna
reactions that constitute the domain where barriers are identified and tools to overcome it are needed. These stakeholders were divided in clusters according to their relation with public transport:

- Public transport operators;
- Public authorities (political / transport);
- Citizens and customers;
- Transport workers and trade unions; and,
- Producers of transport means and services (transport manufacturers)

A systematic approach to analyse barriers is also provided in order to assess the impacts of change on the following dimensions:

- Economic performance;
- Social performance;
- Financial performance

Finally, the last step was devoted to the production of recommendations and guidelines for the management and assessment of regulatory evolution in Urban Transport Operations in Europe.

MARETOPE handbook (guidelines) The synthesis of the work developed are jointly analysed and presented in the format of an handbook. The MARETOPE handbook aims to answer to the following key questions, relevant for those who wish to undertake a change process:

- Who are the key actors in LRF? What is the role of the different actors?
- How can we detect the need for a LRF change?
- How to define strategic goals for the change process?
- How to evaluate the change alternatives?
- Who will be affected by the LRF change?
- How should authorities organise processes, while assuring performance levels during transition period?
- How can we monitor and adapt the mobility system to meet the citizens’ needs?

Structure of the Handbook This handbook is structured along three main parts, each one with clear objectives and structure in such a way to enable the reader to follow a logical sequence from the diagnosis of the current situation towards the implementation of the change path.
The first part of the document is dedicated to the reference framework, that is to establish a common platform for understanding the problem of regulatory and organisational change as well as providing a clear and concise overview on the main subjects of the regulatory change, meaning to present the key issues under discussion, how the other cities are moving, which results have been identified in the course of the research.

The second part of the document is fully concerned with the development of a practical diagnosis exercise, where the reader is asked to answer to a set of questions based on which he can determine its current position in the evolutionary path as well as its performance levels. Having the knowledge on the actual situation, the reader is then invited to analyse if there is a need to change and if so, which steps are implied in the establishment of the target and strategic change objectives.

For that, an evaluation of change alternatives or change vectors is undertaken, meaning that for each of the movements “from x to y” and whenever there was evidence from research, foreseen impacts, barriers and tools are highlighted.

The last section is then dedicated to the implementation and management of the change path, this is to the development of a road mapping for the managing of the transition. Principal aspects that are reflected in this section concerns the how to minimise the impacts of the change process as well as the most adequate tools that will facilitate such smooth transition.

Where to find more information
This handbook as well as all the relevant material produced in the framework of the research is stored in the project web site www.tis.pt/proj/maretope/maretope.html.

Over the 30 months of research a set of relevant information was collected, analysed and reported in the following project deliverables:

- D1 - Reference framework and harmonisation of concepts

  The deliverable provides the main general reference framework for the research throughout Maretope. It is meant as a tool to ensure that all participants to the consortium get on the same wavelength before any data collection such as to avoid misunderstandings and miscommunications later on during the work. The reference framework is based on previous research work including, amongst others, the results of...
the Isotope, Quattro research projects, related consultancy works. However it also includes additional elements, originating from other publications or specially developed for the purpose of this general reference framework. This document also contains a number of definitions such as to ensure a further harmonisation of the concepts used by the participants to the consortium. However, this deliverable starts with clarifying the scope of Maretope.

- **D2 - Updating views on the current legal, organisational and financial frameworks of local public transport systems**

  This deliverable provides the updated views on the developments that have been promoted over the last years at EU and national levels. In particular, the report focus on the assessment of the past, the present and the future plans.

  The developments within the Member States were at the core of this deliverable. Country reports shows that it is hard to mention Member States where public service obligations/requirements and the award procedure used for (current or future) contracting is not subject of intense debate. The relevant question is to what extent relevant national frameworks will be touched/influenced by the directly binding provisions of the future EU legislation.

- **D3 – Intermediate report on the development of case studies**

  This report contains the description of the 29 cases studies providing a quick and brief overview on:
  - The background situation
  - The current situation, developments and/or future plans
  - The triggers for discussion on reform
  - Main vectors of change, barriers raised and tools adapted or foreseen to overcome those barriers

In the first part of the report an overview on the main intermediate findings is included, followed by a short description of each case study. These descriptions give a quick and brief overview of:
  - The background situation, contemplating the aspects related with who has the right of initiative, STO decision making approach, role of authorities in terms of selection and contracting of operators, monitoring and control, subsidising and financing
  - The current situation, developments and/or future plans
  - The triggers for discussion on reform
  - Main vectors of change, barriers raised and tools adapted or foreseen to overcome
those barriers

A confidential annex with the full description of case studies, including organisational facts, barriers and tools as well as preliminary quantitative assessment was also produced.

- **D4 – Synthesis of case studies**
  This report consists of case study descriptions and first analyses with regard to:
  - organisational and legal change,
  - the barriers encountered to this change and tools implemented to overcome these barriers, and
  - the evaluation of the quantitative performance before, during and after the process of change.

The extensive and detailed information contained in this report will provide the basis for an impact analysis and the development of tools to assist key players in the process of change.

The report is composed by a main report containing the synthesis of case study findings and four appendixes containing the full description of the cases. For reasons of confidentiality, which are especially pertinent to operators, the quantitative performance analysis and qualitative interviews of the case were included in a confidential annex.

- Appendix A – Organisational forms and reforms
- Appendix B – Barriers and tools
- Appendix C - Quantitative performance analysis - data and graphs (CONFIDENTIAL)
- Appendix D – Qualitative interviews (CONFIDENTIAL)

- **D5 – Assessment of Impacts of change**
  In this deliverable it is reported the analysis undertook to identify and assess the impacts associated with the regulatory change of Local Public Transport Systems (LPTS), distinguishing where possible between bus and fixed track (rail) systems. The principal methodology related to quantitative results was developed based on a pooled cross-sectional and time-series database of 31 cities over the period 1990 to 2000.

- **D6 - Barriers to Change and Tools to Assist Key Players in the Process of Change**
  This report presents the results of the work undertaken within the WP4 of the MARETOPE project, whose objectives are:
  - The identification of barriers to regulatory changes;
  - The identification of tools to facilitate the regulatory evolution;
- The development of tools to assist key players in the process of change.

- D7 – MARETOPE handbook (that is, the current report)
  Consists in a set of guidelines and orientations on how to manage the transition and changes in regulatory framework, providing recommendations on tools for management of those periods, taking into account the different regulatory and organisational settings as well as they will be target for the different type of actors involved in the local public transport organisation.

1.2. MARETOPE Partnership

MARETOPE consortium

The consortium that undertook the MARETOPE research gathers the experience and expertise of partners from 13 European countries, 10 from the EU, plus Switzerland, Hungary and Norway.

The project co-ordination was assured by TIS.PT, Consultores em Transportes, Inovação e Sistemas, SA, from Portugal, José Viegas and Rosário Macário, who were also responsible for the final edition of the current report, in partnership with the following entities:

NTUA, National Technical University of Athens  
NEA, Transport Research and Training  
ERASMUS, Erasmus University Rotterdam  
ISIS, Instituto di Studi per l'Informatica e I Sistemi  
TSU, Chancellor Masters and Scholars of the University of Oxford  
HGL, Halcrow Group Limited  
TOI, Institute of Transport Economics  
LT Consultants, Ltd.  
HUR, Hovedstadens Udviklingsrad / Trafikdivisionen (former HT)  
TRANSTEC – Consult, TransTec Transport und Technologie Consult Hannover GmbH  
HVV, Hamburger Verkehrsverbund GmbH  
FGM-AMOR, Forschungsgesellschaft Mobilitaet  
INFRAS  
ENPC, École Nationale des Ponts et Chaussés  
TRANSMAN, Transman Consulting for Transport System Management Ltd

Subcontractors

Two main subcontractors were involved in the MARETOPE project:

- Kjell Jansson from Sweden and
- Tero Antilla from Finland.
Accompanying Board Members

Besides, over this 30 months the MARETOPE had benefit from a constant exchange of opinions with the almost 30 members of the accompanying board of the project, that bring to the research the daily views of the problems. Such contact was assured either through their direct participation in the case studies, or through the participation in three dedicated meetings to present results and assess the adequability of the research to specific user needs.
2. **REFERENCE FRAMEWORK**

2.1. **Key questions within the reference framework**

Key questions within the reference framework: The reference framework used within MARETOPE was meant to ensure a common vocabulary and representation framework for all of those either directly involved in the research, or with key interests in the field. It was focused on the legal, regulatory and organisational issues that are determinant for the functioning of public transport systems and that are essential in understanding the appearance of barriers to change and in understanding the functioning of tools to alleviate such barriers.

In particular, the reference framework focus on the clarification of concepts of the organisational forms. The analysis of this chapter will enable the answer to the following questions:

- Who are the key actors in LRF?
- What is the role of the different actors?
- How can we monitor and adapt the mobility system to meet the citizens' needs?
- What is in discussion?
- How are cities evolving?

Who are the key actors in LRF? A variety of actors could be affected or can influence the regulatory change. In the MARETOPE research those actors were considered as belonging to one of the following stakeholders group:

- Public transport operators and associations
- Public authorities (transport / political)
- Citizens / customers
- Employees and trade unions
- Producers of transport means and services

Each of these actors establishes a set of relationship among them, either formal or informal. Besides the transport authorities and operators that have a more direct role in the LPT systems, we can, for instance, highlight the role of customers/citizens, In general, they are involved more indirectly in the planning of the LPTS (e.g. acting as principal for the public authorities), however, the pressure on operators to provide transport services satisfying customer requirements is an important (indirect) influence from customers. On the other
hand, the trade unions constitute a special stakeholder, whose influence and opposition can be determinant of the whole change process. Also the influence of producers of means and systems on the planning process/outcome can show a large degree of variation. This stakeholder can impose significant constraints in terms of the feasible solutions to the transport provision.

In figure 3, a simplified representation of the relations between stakeholders that constitute potential fields where barriers can be originated is highlighted.

**Figure 3 - Conceptual simplified representation of stakeholders’ relationships**

**What is the role of the different actors?**

The role of each actor is thus dependent and influenced by the legal/regulatory framework in place. The research also indicates that past experiences, qualifications and aims influence the perception and the ways that each actor react during the process.

It is possible to distinguish between “active” and “passive” roles and reaction undertaken by each actor. An active reaction is associated with an aggressive, action-driven reactions and can be expressed as an attack. On the other hand, a passive reaction can be expressed as an escape. It is clear that authorities, operators and trade unions have a more active role in the process than the other groups. This is naturally due to their central role and competencies within LPTS organisation and functions that involve them in the development of the systems.

The organisational setting presented in each case is thus a natural conditioning to the roles undertaken by each actor.

Right of initiative

The figure 4 presents a global classification of organisational forms as can be encountered
in public transport in Europe. The first distinction presented in the diagram is the dichotomy between ‘authority initiative’ and ‘market initiative’. This distinction refers to two fundamentally different categories of organisation of the supply of public transport services and relates closely to the legal framework within which these services are meant to appear.

In authority initiated regimes, those authorities which have received the responsibility for transport (further called ‘transport authorities’) have the legal monopoly of initiative. This means that autonomous market entry is legally impossible and that all production or market entry is the result of a conscious one-sided authority initiative to produce or request the production of services. An example of an authority-initiated regime can be found in France outside the Paris Region. In market initiated regimes, the supply of transport services is based upon the principle of autonomous market entry resulting from a market process with more or less regulatory checks at the entrance. Examples of this system can be found in local public transport in Great Britain, but can also be found in Germany although there is limited freedom and little or no new market access.

It should be noted that all regimes presented in this figure can make use of competitive tendering to contract out parts or whole of their activities. This stresses that competitive tendering is merely a selection mechanism in the context of outsourcing, it is a method of production available to any initiator of services (both authority and private entrepreneur).

- Authorities can play several roles, in both regimes:
  - Licensing authority: granting access to the profession (in all regimes),
  - Authorising authority: granting access to the market (in market initiative regimes),
- **Concessioning authority:** granting access to the market (in authority initiative regimes),

- **Regulatory authority:** setting the ‘rules of the game’ for operators present on the market, together with the actual watchdog or referee monitoring and enforcing the rules of the game in all regimes,

- **Enterprising authority:** when the authority creates and bears the entrepreneurial risks on transport services she creates either by owning a public transport company (or non-corporatised internal division producing transport services) or by outsourcing the production of services she has designed. This either under authority initiative (legal public monopoly) or under market initiative (the services created by the authority have to be granted an authorisation by the authorising authority), and

- **Subsidising authority:** for two purposes: stimulate the general supply of services and redistributing wealth to politically chosen target groups in society (such as handicapped, elderly, unemployed, ...).

It is important to state that the classification presented above only represents a number of ‘pure organisational forms’. Few real-world examples will fully correspond to any of these organisational forms. Only a careful reading and understanding of the legal, regulatory and organisational frameworks will be able to deliver the necessary information to position each real-world organisational form in relation to these ‘pure organisational forms’.
Intermediate forms may be desirable, are possible and do exist in reality. In real world cases, ‘delegated management’ and ‘concessioning’ can also sometimes be observed in combination with each other, all depending on the sharing of risks between authority and operators. ‘Two step regimes’ can also be observed. In market initiative regimes, e.g., the authority can be given a role as complementary initiator of (social) services, such as in the British bus sector. Such services are then however outsourced to private operators selected by competitive tendering.

Another way to represent this is to say that there is a ‘continuum’ of possibilities between, on the one hand public management and (private) concessions and, on the other hand, strict authorisations and open market entry. The figure 6 gives a representation of this, using the same extreme points as in previous figure, but emphasising here the continuum that exists in between these extreme points. In this graph, and for both authority initiative and market initiative, a gradual change can be perceived from the more open regimes, submitted to more market pressure and/or private entrepreneurial freedom (in blue) to the more controlled, static and closed regimes in terms of market entry (in red).

A combination in the reverse order is also possible and is encountered in Britain in the railway sector. A different version of the combination of market initiative with authority initiative is also present in the current German local passenger transport legislation. According to the principles of that legislation autonomous market entry regulated by a system of authorisation provides for all profitable services. Additional non-profitable services can then be provided but have to be tendered by the responsible transport authority. However, as in Germany, legal principles do not always correspond to the reality as various subsidies and cross-subsidies blur the distinction between profitable and non-profitable services. Finally, an often observed confusion is that between authorisation regimes dominated by authority-owned companies and public management under authority initiative regimes. While these forms do indeed function similarly in practice, they are based on fundamentally different legal regimes. In a context of change, and for the analysis of the barriers to change, it is essential to distinguish clearly between law and practice there were relevant. In some cases practices will be easier to change than the law, in other cases changing the law will be the only way for practices to evolve.
Levels of planning and control

Public transport is a service provided on a market; i.e. there is a supply, there is a demand and there is a price – even low or subsidised – to be paid to use the service. Similarly to other markets for goods or services and whatever the legal and regulatory setting, a number of decisions will have to be made before passenger transport services can actually be produced and sold.

It is generally accepted that planning and control systems within companies can be divided into hierarchically ordered types of activities, we will use here the following denominations:

**Strategic level:** strategic planning is involved in the formulation of general aims and in the determination in broad terms of the means that can be used to attain these.

*In short: what do we want to achieve?*

**Tactical level:** tactical planning is about making decisions on acquiring means that can help reaching the general aims, and on how to use these means most efficiently.

*In short: what product can help us to achieve the aims?*

**Operational level:** makes sure the orders are carried out, and that this happens in an efficient way.

*In short: how do we produce that product?*

Figure 6 translates these to the public transport sector, without yet referring to any specific legal or regulatory setting (this example refers to a simple bus networks for small-scale cities; terms would obviously be longer when fixed infrastructures are involved):

<table>
<thead>
<tr>
<th>Level</th>
<th>General description</th>
<th>Decision</th>
<th>“Software”</th>
<th>“Hardware”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic</strong></td>
<td>What do we want to achieve?</td>
<td>General goals</td>
<td>Transport policy</td>
<td>Vehicles</td>
</tr>
<tr>
<td></td>
<td>Long term (5 year)</td>
<td>Market share</td>
<td></td>
<td>Routes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profitability</td>
<td></td>
<td>Time-table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General description of the services</td>
<td>Area</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Target groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Intermodality</td>
<td></td>
</tr>
<tr>
<td><strong>Tactical</strong></td>
<td>Which services can help to achieve these aims?</td>
<td>Detailed service characteristics</td>
<td>Fares</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium term (1-2 year)</td>
<td></td>
<td>Image</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additional services</td>
<td></td>
</tr>
<tr>
<td><strong>Operational</strong></td>
<td>How to produce these services?</td>
<td>Sales</td>
<td>Selling activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short term (1-6 months)</td>
<td></td>
<td>Information to the public</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production</td>
<td>Infrastructure management</td>
<td>Vehicle rostering and maint.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Personnel rostering and mgnt</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 6 - Levels of planning and control in public transport*
In opposition to the hardware side, which is the production of vehicle-kilometres, we define the software side as everything that will help to sell the vehicle-kilometres, i.e. transforming them into passenger-kilometres. Seen from a dynamic perspective, there has of course to be a feedback between the decision levels involved, notably based on the feedback provided by (potential) clients.

It should be noted that the strategic, tactical and operational levels considered here are seen from the point of view of the appearance of transport services to the passenger, i.e. at the system level, and not from the point of view of a specific (private) transport operator involved in production somewhere in the chain of actors, i.e. at the actor level. Indeed, any such actor will have its own strategy, tactics and operations and these should not be confused with what is presented above.

As for any production, one or several actors can be responsible for each of the decisions presented in the table. In general the strategic-tactical-operational chain can be seen as a (series of) principal-agent chain(s). Numerous forms of organisation of this chain of principal(s) and agent(s) are possible. Using the levels of planning and control as presented above, together with the insights provided by the classification of organisational forms, it becomes possible to draw graphical representations of both existing and conceptual organisational forms in public transport. The focus here is on the role of the authority (or authorities) as concessionary authority, taking the initiative for the creation of services and heading the chain of actors, and in its role of authorising and regulatory authority when controlling market initiative.

What is in discussion? The last years have witnessed in a number of European countries significant changes in the legal and organisational frameworks of local public transport in order to ensure an improvement in transparency, economic efficiency and quality of the service. The European Commission promotes this development through the provision of an appropriate legal framework at European level. However, it should be made clear that whatever regulatory regime is in force, its success strongly depends on the effectiveness of the relationship between authorities and operators. That is, one of the main functional roles of authorities is to induce operators to conduct their business towards the achievement of the strategic goals of the system (i.e. principal-agent theory), for which complementary schemes of incentives and penalties are an indispensable tool.
All these developments confirm the importance of the efficiency concept, both in the production and in consumption (i.e. efficiency from the users viewpoint), of local transport systems as one of the main building blocks for sustainable growth and employment in Europe, as well as to contribute to economic and social cohesion for which local transport services play a determinant role by being safe, affordable, easily available and reliable, and last but not least delivering a quality that fulfils citizens needs and expectations.

In fact, based on research and consultancy studies done since 1995, it is now the limited competition regime (under a new designation of controlled competition) the one which gained the preference of the European Commission, reflected in the proposal to the Parliament for regulation of public service in land transport services 4.

Indeed it is correct that those background studies revealed that productive efficiency pressure was more effectively applied through tendering processes, with the authorities taking the role of the entrepreneur, defining the services and trying to obtain the lowest cost from the best offers of the competing operators. In parallel, efficiency in consumption would be pursued through regular quality surveys on satisfaction of existing customers.

However, from those not so late years up to the current days, experience revealed that a deeper involvement of the operators was needed to cope with a "new mission" of public transport in the improvement of urban living conditions. As a consequence a general movement from gross costs to net cost contracts could be observed, confirming that the selection of operators just on the basis of the lowest price bid to produce a pre-defined service entails substantial risks of downgrading quality of service (or at least not enough stimulus to improve it).

The EU policy and legislative framework

Transport is a major component of public service. The Commission refers to the EC Treaty that stipulates that “Aids shall be compatible with this Treaty if they meet the needs of coordination of transport or if they represent reimbursement for the discharge of certain obligations inherent in the concept of a public service”. In its section on public services the White Paper cites the Nice’ European Council of December 2000: “there is a need here especially for clarification of the relationship between methods of funding services of general

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economic interest and application of the rules on State aid. In particular, the compatibility of aid designed to offset the extra costs incurred in performing tasks of general economic interest should be recognised, in compliance with Article 86(2)". The public service may involve special arrangements. But measures taken must be neutral and comply with the proportionality principle. The Commission identifies a need for a simplification of procedures for notifying State aid, particularly in relation to some public service obligations.

In a number of member states, the organisational frameworks for public transport have been progressively subject to some change processes in order to promote improvements towards more transparent, efficient, effective and quality transport services, in line with the intentions advocated by the EC in the different policy papers produced over the last years:

- The Green Paper on the “Citizen’s Network” – from 1995 has been given a follow up by the Commission in the communication “developing the citizens network”. One of the key roles of the EU that is foreseen in this communication is “creating a policy and legal framework that promotes better use of local and regional passenger transport systems”. The European Commission carefully formulates in this communication carefully “the best way to achieve (service) integration may often be to grant an operator the exclusive right to operate a particular type of public transport service in a particular geographical area”. Still it is argued that exclusive rights have to be offset “against the risk of complacency, unresponsiveness to changes in customer needs and in the attractiveness of competing forms of transport and poor value for money for public expenditure”.

- The EC Communication “The Common Transport Policy - Sustainable Mobility: Perspectives for the Future” moreover makes clear that “the Commission will also reflect on how the regulatory framework for domestic public transport might be updated (for example through the use of clear contracts including quality targets), to ensure that all interested parties including local authorities, operators and user groups achieve the maximum benefit”.

Concrete actions are taken by the EU through elaboration of European directives and regulations. General state aid and public procurement rules are important to public transport as they can be applicable. However at the heart of the debate in tendering and contracting in public transport in Europe is a revised proposal for a regulation “concerning public service requirements and the award of public service contracts in passenger transport by rail, road and inland waterway” (COM 2002, 107).
EU legislation in the field of public service obligations is not new. The regulatory proposal as issued for the first time in July 2000 (COM2000 7 Final) and in revised form February 2002 (COM 2002, 107), will replace regulation 1191/69 as amended by regulation 1893/91. Main reason for the revision is that the old regulation –that considers public transport as exclusively national, regional or local business- no longer matches with the market developments in Europe where a European market for the provision of public transport services has appeared.

There is a general consensus that, in Europe over the last ten years, public transport market has gone through significant changes. According to the draft proposal a majority of Member States have introduced an element of competition in their legislative and institutional framework for public transport. Therefore, the European Commission wants to establish clear and fair rules for competition in public transport across the EU.

In the end it is expected that fair award procedures for public transport contracts do not only ensure fair market conditions but also improve the level of services of public transport. Various EC policy papers show the Commission's concern on the market position of public transport vis-à-vis other modes of transport (especially private car use). The Commission proposal is based on various research such as the ISOTOPE study that demonstrated that costs of production were highest in closed markets and the consultancy study ('Examination of Community law relating to the public service obligations and contracts in the field of inland passenger transport').

The proposal has led to strong debate in Europe. The revised version of early 2002 tried to deal with some of the criticism as issued by the European Parliament and stakeholders on the first version. However it remains very uncertain whether the toned down proposal will be adopted in the end.

Herewith we present some highlights of the proposal in order to grasp the content:

- **Scope:** the regulation shall apply to national and international operation of public passenger transport by rail, road and inland waterway. It lays down the conditions under which competent authorities may compensate transport operators for the cost of fulfilling public service requirements and under which they may grant exclusive rights for the services operation of public passenger transport
MARETOPE Handbook

2.2. Regulatory changes at National and local levels

Member States developments

The central driving force for change in most European states was financial constraints: the cost coverage of public transport was regarded to be too low and the amounts of money involved with subsidies too high. However additional driving forces can be observed too:

- The need for a better quality of service in order to meet better the objectives of the...
Citizen's Network policy document;
- The need for a more efficient and effective spending of money to reach a positive change in modal split and number of passengers
- The need to enforce the position of the customer by giving him influence in the organisation of public transport
- The need to create a proper sustainable financial framework in relation to the use of public funds
- the foreseen European regulations on land transport

In several countries competition for the concession has been formulated as the regime of the near future and the transition process has been organised to facilitate this. The influence of the authorities is large here, having the possibility to organise public transport as a tool in urban development. Where competition has been introduced this has shown efficiency improvements. Since positive changes in ridership could not be gained at the same amount, new and improved tools are being developed to raise the quality of the services under a competitive regime.

In the UK developments have gone the most far. Outside London a regime of competition on the road has been introduced with additional tendering of unprofitable services. Where market imperfections could form barriers new tools have been introduced to overcome this.

Other countries are still at the start of the process. The desire to maintain integration, even in a competitive environment, and the necessary reform and/or privatisation of public companies are perceived as difficulties, which are then forming barriers to implement changes in public transport. In these countries the expectations of the effects of change are rather low, while the efforts necessary to implement a change are perceived to be too high. However changes are needed due to financing problems, enforced by the disappearing of possibilities for cross financing. Subcontracting has been proven to be a first step to improve efficiency in these cases.

In Central Europe the driving forces are slightly different compared to Western Europe. The financial position of the central governments has (even more than some Southern European Member State countries) had a key impact on the developments. In many countries budgetary constraints lead to a process of decentralisation without adequate shift of the needed financial resources to the lower level, thus leading to reduced services. Moreover
ridership is falling harder here due to higher motorization experienced earlier in Western Europe. In some Central European countries prices have increased considerably while other countries – under social pressure – have kept prices on their former low level. However liberalisation is in progress in Central Europe too, sometimes even faster then in Western Europe. Legal reforms are made or are in preparation to meet EU standards at the time of accession.

A curiosity in Europe seems to be that public transport in many capitals (and capital regions) are organised in a different manner compared to other areas in a country. London and Paris are famous examples of this but also Dublin, Brussels, Athens and Copenhagen have a different regime compared to other cities in the same countries (in some cases the 2nd largest city however operates following the same ‘special regime’). The special regime is usually being justified by the complexity of the network including rail bound services. Except in London and Copenhagen, the speed of reform using competition in these “special areas” is lower compared to the rest of the country.

A constraint is clearly that the public transport market has little experience with these kinds of constructions, especially at the local and regional level. In the Netherlands a special institution has been established to support local governments in for example the organising of tendering procedures and conclusion of contracts.

Another interesting element of the shift towards market forces is the need for a different kind of regulation (not in the first place deregulation but ‘re-regulation). Besides the governments have to establish a watchdog to prevent abuse of powers (an authority that ensures fair competition).

Looking more closely at the impact that the new EU regulation might have for practice is a difficult task since we are aiming at two moving targets. First, the revised EU regulation has not been adopted yet and is thus still subject to change and, second, also on Member State level many regulatory initiatives are in fact pending as well.

Under the current proposal, rail bound services and large cities with mixed services operators can, to some extent, continue the practice of direct contracting. However, medium sized cities in Europe – cities with service contracts above the EU threshold but without possibilities to exclude themselves from the full application of the proposed regulation – will
have to deal with the full impact of the changes:

- Competitive tendering
- Contracts of no longer than five years (if this obligation remains)
- Reorganisation of the position of in house production and creating of separate accounts for the public service contracts

The outcome might in fact be that a market for public transport service contracts in Europe will in the first place occur at the level of medium-sized cities and regions while small cities organise their own services (below the EU threshold) and large cities with rail bound services use the exemptions and maintain a more protected market. However these are only predictions.

If we consider the current status in the countries a few basic distinctions can be made with regard to the transition stage and political targets. In fact, four main groups of countries can be described. The four main groups are:

- Countries with a highly deregulated and privatised market (UK)
- Countries in transition towards competition by public tendering (Scandinavian countries, Netherlands, France, Italy, Belgium Flanders region)
- Countries with a mixed public / private regime without public tendering (Germany, Belgium Walloon region Luxembourg, Greece, Portugal)
- Countries in decentralisation and privatisation process (Central European countries)

Countries within each group have some common characteristics as well as some interesting differences. The groups are described below.
### Table 1 - Countries grouping by transition stage and political targets

<table>
<thead>
<tr>
<th>Group</th>
<th>Deregulated and free market</th>
<th>Transition towards tendering</th>
<th>Mixed public/private regime without tendering</th>
<th>Decentralisation and privatisation process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td></td>
<td>Scandinavia countries, Netherlands, France</td>
<td>Germany, Italy, Portugal, Luxembourg, Austria</td>
<td>Central European countries</td>
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<tr>
<td><strong>Similarities</strong></td>
<td>Private initiative</td>
<td>Public tendering introduced</td>
<td>No privatisation (yet) of (some) public companies</td>
<td>No transition (yet) towards tendering</td>
</tr>
<tr>
<td>Deregulated market</td>
<td></td>
<td>Not yet applied everywhere</td>
<td></td>
<td>Financial problems at local and regional level</td>
</tr>
<tr>
<td>Tenders for loss-making lines</td>
<td></td>
<td></td>
<td></td>
<td>In privatisation process</td>
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<tr>
<td><strong>Differences</strong></td>
<td>Some countries already in ‘the new’ (S)</td>
<td>Contracting and initial experience with tendering</td>
<td>Some countries have already legislation to introduce compulsory tendering (A, I)</td>
<td>Some countries are ahead (H, CZ)</td>
</tr>
<tr>
<td></td>
<td>Others in middle of transition (NL, FR)</td>
<td>Some countries have already experience with tendering</td>
<td></td>
<td>Some countries face competition of paratransit (BG, LT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some countries have already transition towards tendering (PL, H)</td>
<td></td>
<td>Some countries started with tendering experiments (PL, H)</td>
</tr>
</tbody>
</table>

Having summarised the developments at member state level, it can be said that there is nearly no single region in Europe where tendering or at least contracting is no issue. This seems also to be an ongoing development, no matter whether or not EU regulation is forcing to do so. On the other hand, apart from the UK, Denmark, Sweden and France there are many countries where contracting and especially tendering is not part of common practice. Of course the usage of competitive elements in procedures and duration of contracts differs considerably, but the question is clearly present on the agenda and with that the relevance of the framework that is currently being worked out at the European level is shown.

Assessment of evolutionary models

As previously referred, the MARETOPE research was focused in the change process, assessing two main dimensions within it: by one hand the changes that are mainly reflected at the organisational level and on the other hand, how this is reflected in terms of service.
This twofold assessment dimensions are reflected in the self assessment tool included in this handbook, however it is useful to provide here a general overview of the aspects that must be considered whenever such type of analysis is initiated. This is illustrated in the figure below, focusing it on:

- The Past situation, that is the former ‘stable’ organisational situation and its performance characteristics,
- Reasons for change and preferred situation: trigger for the reform discussion, (ideas on) reform design by its proponents, compromises at that point in time, reform proposal made at that point in time including its aims,
- Regulatory changes developed: legal, organisational and financial reform developed to lead to the preferred situation,
- Transitional path: measures developed to enable a (smooth) transition from the past to the preferred situation,
- New situation: the organisational setting as it has become (note: this may turn out to be different from the preferred situation that was originally aimed at) and its performance characteristics (results of the change).

Evolutionary Patterns: where are cities moving?

The variety of possible regulatory movements is highlighted in the figure below. In fact, movements can be found in different directions, either within the authority or market initiative regimes or movements from one regime to the other.
In view of the assessment of the evolutionary models, MARETOPE has classified 31 case studies accordingly, and has employed a simplified reference framework to the three broad categories of market options:

- **Closed Market**, or temporally undetermined monopoly, in which operators are protected by exclusive rights and no elements of competition are in force;
- **Controlled Competition**, or competition for the market, in which the awarding of exclusive rights (lasting for finite periods) is undertaken through tendering procedures open to all competing operators;
- **Deregulation**, or competition in the market, in which there are no exclusive rights and public transport is driven by market forces.

When considering the above market structures, it is possible to envision the following evolutions:

- **Within a closed market**, through the introduction of mechanisms aimed at improving quality and efficiency or undertaking an organisational reform;
- **From closed market towards a controlled competition**, through the introduction of mechanisms to tender the service among a plurality of competing operators, while ensuring the best quality/cost ratio for the tendered service;
- **From a controlled competition to a closed market**, with the reintroduction of public...
operators;

- **Within controlled competition**, through the introduction of mechanisms aimed at improving the efficiency of the tendering process and the quality of the outcome (i.e. of the public transport service);
- **From a controlled competition to deregulation**, usually to increase the openness and flexibility of the market;
- **Within deregulation**, through the introduction of mechanisms aimed at improving quality and efficiency;
- **From deregulation to a controlled competition**, either keeping a market initiative or moving towards an authority initiative.

Theoretically, evolutions from a closed market to a deregulation and vice-versa are also possible, but they will not be taken into account in the analysis given the extreme odds of such events and no examples in the MARETOPE sample.

Figure 8 shows the above in graphic terms. The black arrows identify the evolutions for which an early review of the 31 MARETOPE case studies has found evidence.

![Figure 9 - Theoretical evolutionary patterns (simplified version)](image-url)

<table>
<thead>
<tr>
<th>Closed Market</th>
<th>Controlled Competition</th>
<th>Deregulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>G</td>
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<tr>
<td>C</td>
<td></td>
<td>E</td>
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<tr>
<td>D</td>
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<td>F</td>
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</tbody>
</table>

Main triggers for reforms

Almost independently from the type of reform undertaken, the central driving force and main trigger that are at the origin of the process is of financial nature.

Other driving forces observed concerns the improvements towards more transparent, effective and quality UPT services, the need to enforce customer position by giving them influence in
PT organisation. The foreseen European regulation on urban transport is also a main driving force to start the change process.

In more detail, the main triggers can be described as:
- Economic and financial considerations along with socio-economic goals;
- Environmental considerations;
- Increase of PT market share and making PT more competitive face to the private car;
- Developments at EU level;
- Reducing subsidisation, bringing more cost effectiveness to PT systems

Although cities adopted different forms to carry on the reforms, the preferred situations corresponds almost to the achievement of the common goals, which are related with:
- Improvement of public transport services;
- Increasing the costs effectiveness of operators;
- Better responses to user needs and the consequent attraction of more passengers;
- Financial upturn of the transport sector

### 2.2.1. Impacts

**Performance results**

Performance assessment was conducted taking into account three main dimensions influencing it, that is:

- **Productive efficiency** covering the transformation of resources into transport production (productivity analysis);
- **Network design**, covering the correspondence between those units of transport production and the accessibility levels in the various parts of the territory served (service supply analysis)
- **Commercial effectiveness**, covering the potential represented by the accessibility levels into real consumption of public transport by its clients and the revenue generated (effectiveness analysis)

With respect to **productivity analysis**, three measures were examined, namely labour productivity, cost performance and technical efficiency.

Almost all cities in the sample have experienced increased labour productivity (Vkm/Sn) over the last decade. In particular, labour productivity increases were strong for cities with controlled competition involving a plurality of operators or cities with complete deregulation. It
should be noticed that the trend regarding vehicle productivity (Vkm/Ve) indicates mixed picture. A large number of cities have experienced somewhat lower levels, while some cities have experienced higher levels. Lower vehicle productivity could though be the result of decisions to improve the public transport available.

In the econometric analysis on the pooled data set labour productivity (Vkm/Sn) was to found to increase if competition is introduced and was reduced if the dominant operator was publicly owned. For bus systems, tendering was also found to increase productivity whilst public ownership was found to reduce productivity. For rail systems, tendering was found to increase productivity strongly.

Most cities have over the last decade improved cost performance measured in terms of changes in real unit costs. In particular, improvements occurred for cities with controlled competition involving a plurality of operators and cities with complete deregulation.

A technical efficiency measure was developed which examined the efficiency with which vehicle kms are produced from vehicles and staff. A technique called Data Envelopment Analysis⁵ was utilised. The results suggest substantial inefficiency present within European Public Transport System. Our econometric results for LPTS, indicated that the efficiency scores were substantial lower for publicly owned operators, higher where operators bear production risks and also higher where operators bear both production and revenue risks. For

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⁵ Data Envelopment Analysis calculates an efficiency score for each observation through comparison of the inputs used and outputs produced to the other observations.
bus, the differences were smaller compared to LPTS. It was still found that the efficiency scores were lower for publicly owned operators, higher where bus operators bear the production risk and also higher where bus operators bear the production and revenue risks (although the last of these results was not statistically significant).

With respect to service supply, we were unable to construct an ideal measure of accessibility. Instead two proxy variables of vehicle-km divided by capita area and vehicle-km per area were utilised. Our time series results suggest a mixed picture for service supply. Some cities have experienced increased level of service supply (measured as vehicle-km per capita) while for other cities there have been decreases. Cities moving towards controlled competition have generally experienced positive increases in service supply.

The cross-sectional (econometric) results indicate that service supply measured through the proxy vehicle-km per area is high in those cities where the dominant operator is publicly owned. However, it appears that the proxy is even higher in those cities where tendering is introduced. It should be noticed that in the MARETOPE context this indicator is influenced by variation in population density between the case study cities.

Time series information regarding market effectiveness (measured in terms of public transport demand per capita) shows increases for some cities while strong reductions for other cities over the last decade. Reduced public transport usage is generally the case for cities with closed market frameworks. Increased public transport usage is mainly found for those cities with controlled competition (incl. those moving towards controlled competition).
Impacts on actors

With respect to qualitative analysis, based on stakeholder analysis, a range of different impacts was identified. Although there was general support for the broad principle of regulatory change, all groups had specific objections. This was particularly true of competition-based (or product market) reforms rather than organisational (or capital market) reforms. As might be expected the biggest objections came from the LPTS employees and their trade unions where there were specific concerns regarding job losses, declining real wage rates and worsening working conditions. However, it was also noted that the greater number of employers in LPTS could have some benefits for employees and their trade unions.

Public transport equipment manufacturers noted that reforms could lead to temporary investment freezes and subsequent patterns of investment peaks and troughs. Reforms could also lead to the proliferation of non-standard specifications. However, in some markets (notably for rail) reforms had led to the standardisation and modularisation of equipment, which had enabled manufacturers to exploit economies of scale at a European level and hence reduce costs. It was noted that the views of public transport operators, public authorities and citizens/customers might initially be against reforms but would often become supportive. This might especially be so where reforms are accompanied by measures such as improved bus priority and increased parking charges and parking controls (as in Oxford, for example).

2.2.2. Barriers & Tools

Before detailing the results of the research undertaken at the level of barriers and tools, it is worth to start by the definition of a barrier and a tool. Within the context of MARETOPE, a barrier represents always a negative event hindering, preventing or controlling the process of
change. A tool, on the other hand, is anything that is used to overcome a hindering or delaying situation within the change process.

In chapter 4 the detailed desegregation and explanation regarding the different characteristics and environment of barriers and tools. Herewith the objective is to highlight the principal aspects identified, so that the reader can obtain an overall picture on the most frequent barriers to regulatory change as well as the tools that surveyed cities have adopted during their evolutionary path.

Barriers and tools present particularities within each of the above mentioned change patterns. Those are presented in table 2 below, where it is illustrated for each of the simplified change patterns, the common barriers and tools. The graphics here presented illustrates barriers and tools at a more general level, without distinguishing their change patterns.

In relation to its nature

In what concerns the nature of the barrier, most common barriers characterises for being related with:

- **Cultural**: Opposition to competitive Regime, Lack of Political Will, Lack of Skills and Experience
- **Legal**: Unclear Framework, Financial Instability
- **Regulatory**: Market Failures and No Perfect Competitive Markets (Lack of Competitors, Obstacles for New Entrants, Conflicts of Interests)
- **Governance**: Unclear Role of Authorities and Operators
- **Contractual**: Insufficient Financial Resources, too Strict Contractual Negotiation Frameworks, Unclear and too Detailed Contracts

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![Graphic 4 – Barriers by nature level](image-url)

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MARETOPE Handbook 43
The nature of tools corresponds in general lines with the ones from barriers, however it is worth to notice the relevance of the governance tools when compared with the others, which indicates that governance tools can be used to overcome or to minimise the effects of other barriers nature:

- **Cultural**: Protection of Worker's Rights and/or Wage Levels, Direct Dialogue, Training Programmes, Advisory and Supporting Bodies
- **Legal**: High-Level Consultation, External Advice, Increased Funding, Long-Term Contracts
- **Regulatory**: Direct Regulation and More Flexibility for Operators to Avoid Cartel Formation, Changes of Subsidies Policies
- **Governance**: Institutional Restructuring (PTA, Centralisation of Responsibilities)
- **Contractual**: Restructured Financing, Long-Term Contracts, More Clear Criteria in Tendering Requirements

**Graphic 5 – Tools by nature level**

The hierarchical levels in which barriers and tools are developed refers to:

- **Within actors**, that is the barrier or the tool is specific to a certain actor;
- **Between actors**, involving the relation between different actors, and
- **System level**, that is the barrier and tools are identified as affecting the whole system, that is they involve more than two actors and address mostly interactive relationships

From the research we have identified that barriers are primarily recognised as affecting the system (43%), followed by the barriers acting at the actor level (24%). However, in what concerns the tools they are developed primarily for the relation between actors (40%) almost with the same weight as for the system (39%), which can signify that tools tend to be designed as global ones, i.e. the tool that is used to overcome a barrier between actors can also serve
to overcome the barriers within each of those actors.

In relation to STO levels, research revealed that barriers are identified mainly at the strategic level, while tactical and operational levels are equally represented.

Interesting is the fact that in spite of the fact that barriers be considered as acting on the strategic level, the tools have also been developed to apply at lower levels as demonstrated in our case studies.
In relation to the stage of the reform process, it is interesting to notice that both barriers and tools were considered as acting mainly in the realisation stage, that is in a stage where the results of change become evident.

This is somehow in contradiction with the real stage of the change process that in the majority of the cases analysed is still in the implementing stage (i.e. undertaking the necessary changes enabling the implementation of the desired policies), however, this can be understood by the difficulty to clearly split the implementing form the realisation stages.

Also notable is the fact that barriers identified and tools developed be consistent in relation to the stage of the reform process.
Most common barriers by evolutionary pattern are detailed below:

**Closed Market**
For cities moving to closed markets from controlled competition just some minor difficulties concerning the legal and regulatory status of the main operator have been encountered; a general consensus existed in considering the return to the public owned operator solution as the preferred one.

For cities staying in closed market and aiming to improve quality and efficiency just some internal changes have been undertaken because it existed a general consensus on satisfaction about the present situation and only some minor obstacles have been detected.

Finally, cities within a closed market and undertaking an organisational reform seem to share some common characteristics. At the outset of the reform process, this is opposed by most of
the stakeholders for a variety of reasons (e.g. protection of salary, defence of interests, fear of losing privileges, acquired positions and political contrasts). The lack of clear objectives together with lack of consensus among the stakeholders may result in an unclear legal framework, a lack of co-operation and unclear definition and allocation of responsibilities. Usually these cities have scarce resources to undertake the change process because the financial system is hardly adaptable to the new requirements and not correctly defined. This contributes to slowing down the implementation of the reform. At a later stage strong opposition to the reform process tends to inhibit a fair competition between established operators and possible new entrants, by avoiding the tendering process on ground of misinformation or other barrier raised. In this context, a fundamental tool is consensus building with all the stakeholders: participation, transparency and involvement of all players helps to clarify the reform process. However this tool is hard to accomplish. In the absence of this specific tool, other pragmatic solutions have been adopted in order to overcome the mentioned barriers: new investments methods, integration of the services, modifications of subsidies and fare system, improvement of the services quality in order to get more financial resources through increased PT demand.

Controlled competition

In this group cities moving from closed market towards controlled competition are included, as well as cities moving within the latter model (both based on authority initiative). In this sense, we can have either the entire PT network assigned to one operator or parts of the PT network to a plurality of operators. A third sub-group is formed by cities equally moving towards controlled competition but starting from organisational forms based on market initiative.

In the first case common traits are the lack of experience with planning, tendering procedures and contractual negotiations of authorities and operators. There is often no real competitive market due to lack of competitors, de-facto monopolies or wrong tendering procedures. Roles and responsibilities of authorities and operators are sometimes not well defined. This barrier is worsened by the lack of co-operation between different levels of authorities and between authorities and operators (in case of partnerships). Within this framework, market failures have been coped with through splitting contracts into several parts, improving the selection criteria and the tendering procedures. In order to better clarify roles and responsibilities, institutional restructuring is used as a common tool (e.g. creation of advisory bodies involving different stakeholders). This group includes cities evolving within a controlled competition in which the market ends with a plurality of PT operators by breaking down the network into several segments and assigning them through tendering procedures.
In the second case common characteristics are: strong opposition to introduce the competitive regime, often due to the resistance of trade unions (but also of the operators and authorities), scarce preparation of authorities and operators to deal with the new planning and tendering procedures, and lack of maturity of the market, which is often not ready for a competitive regime (e.g. persistence of a monopolistic situation, conflicts of interests, obstacles to the incumbents). Other problems include the lack of definition of the role and responsibilities of authorities and operators, and the financial problems afflicting the market (e.g. shortage of resources, weak subsidies policies). Within this framework, a key tool to overcome the opposition of the trade unions is the protection of salaries and working conditions. To fill the skill and experience gap, an important tool is the organisation of training programmes for operators and the development of competencies for authorities (e.g. tendering procedures and contract management). Clarification of roles and responsibilities can be obtained through institutional restructuring such the establishment of advisory bodies and the creation of specific authorities centralising planning and strategic competencies.

A third group of cities, also moving towards a controlled competition but based on market initiative regime, present a situation similar to that illustrated above for the case of controlled competition with a plurality of operators.

**Deregulation** In this group are included cities moving within deregulated regime and aiming to improve quality and efficiency of services.

For cities belonging to the deregulation model, commonly reported barriers are: opposition of trade unions, which is occasionally overcome by reducing the power of the unions through legislation, lack of competencies on the part of authorities and operators concerning tenders and contractual procedures. In general, these obstacles are solved by reinforcing the regulatory and control powers of the authorities. Quality partnerships and reformed subsidy policies are popular tools.

<table>
<thead>
<tr>
<th>Evolutionary Forms</th>
<th>Common Barriers and Tools</th>
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</thead>
<tbody>
<tr>
<td>Closed Market</td>
<td>B: Some minor obstacles encountered in undertaking internal changes;</td>
</tr>
<tr>
<td></td>
<td>T: general consensus on satisfaction about present situation</td>
</tr>
<tr>
<td>Improvement of quality and efficiency</td>
<td></td>
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<tr>
<td><strong>Organisational forms</strong></td>
<td><strong>Public ownership</strong></td>
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<tr>
<td>Authority initiative</td>
<td>'Concessions'</td>
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</tbody>
</table>

| **Management** | **Own management** | **(Dominated by private companies)** | **Own management** | **(Dominated by public companies)** |

| **Coming back to closed market from controlled competition** | - B: Some minor difficulties on legal and regulatory status of the main operator; - T: General consensus on considering public owned operator solution as the preferred one |
| **Organisational reform** | - B: Opposition of the stakeholders and financial difficulties; - T: Importance of involvement of all players and implementation of some pragmatic solutions as key tools |

| **Controlled Competition** | - B: Lack of skills and experience of authorities, not real competitive market; - T: Focus on contractual and tendering procedures as well as institutional restructuring. |
| **One operator** | - B: Opposition to the new regime, authorities and operators unprepared, not real competitive market, not clear division of roles and financial problems; - T: Negotiations with trade unions, increasing skills and experiences of stakeholders and institutional restructuring as important tools. |
| **Plurality of operators** | - B: Opposition to the competitive market, authorities and operators unprepared, not real competitive market, unclear legal framework and instability of financial resources; - T: Negotiations with actors, training programmes, increased competition (for operators), project management, external advisory and support (for authorities), new legal framework, restructuring and privatisation of operators, changes in subsidy and fare policies. |
| **From market initiative** | - B: Lack of skills of operators and authorities and influence of authorities; - T: Increase regulatory and controls power of the authorities (via quality contracts). Statutory arrangements between operators and authorities via quality partnerships. Reforms of subsidy regime. |

<table>
<thead>
<tr>
<th><strong>Deregulation</strong></th>
<th><strong>Improvement of quality and efficiency</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- B: Some minor difficulties on legal and regulatory status of the main operator; - T: General consensus on considering public owned operator solution as the preferred one</td>
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</table>

**Table 2 - Barriers and Tools according to the evolutionary models**
3. **Self assessment for decisions on change path**

Key questions concerning the choice of change path

Within this section of the handbook it is aimed to create conditions that enable each city decision maker to undertake a diagnosis exercise on the need to promote a change process. As such, within this section the following questions will be raised:

- How to make the diagnosis of my situation?
- How can we detect the need for a LRF change?
- How to define strategic goals for the change process?
- How to evaluate change alternatives?
- Do I need to change LRF?
- Do I decide to change LRF?

**How to make the diagnosis of my situation?**

Undertaking an exercise of self diagnosis represents a step ahead of the organisations in their search for the continuous improvement. In particular in the UPT sector such evaluation can be seen in itself as a tool to improve own performance levels and consequently provide a better service to end users.

The diagnosis of the current situation was designed taking into account two main vectors of analysis: by one hand the assessment of the legal and regulatory framework and on the other the assessment of the performance levels of the company, enabling that decision makers could locate themselves in the spectrum of change movements and identify (if wish so) the possible alternatives to move from the existent location.

![Figure 10 – Self assessment process](image-url)
The theoretical basis to complete the assessment herewith proposed was highlighted in the previous chapter. Such information is complemented with the detailed guide for performance assessment included in the annex to this document.

Therefore, in the next pages, the elements over which the diagnosis should be made are identified and explained. Based on the completeness of such exercise the reader should be able to answer to the questions “Where am I?, “Which problems do I have?”.

Assess my legal and regulatory framework

The assessment starts with the identification of how the transport system is organised in your city / country.

It covers the following issues:

- Right of initiative
- Selection of operators
- Role of authorities
- STO decision making
- Contractual relations

Right of initiative

Identify according to the legal framework who has the right to create public transport systems:

a) Authority Initiative
b) Market Initiative

**Authority Initiative:** In this regime, services can only appear from a conscious action by the authority. As such, no services can appear as a result of simple market forces as no legal provision makes such autonomous entry by independent operators possible. In this sense, the authority is in this regime a monopolistic “entrepreneur”. If one takes asset ownership as main classification criteria, a distinction can be made between regimes based on concessioning and on public ownership.

**Market Initiative:** Commercially viable services are meant to appear out of autonomous market process. Market initiative regimes vary from fully competitive “open entry regimes” to “strict authorisation regimes” where the operators are granted a more or less permanent and extensive levels of exclusivity. These should be seen as a two extremes in a continuum.

**“De facto” versus “de jure” authority initiative:** Authority initiative as presented above is “de jure” authority initiative. This means that according to the local law, the authority has the monopolistic right to create passenger transport services. Such a legal situation should not be confused with a common situation where the authority takes “de facto” the initiative to create a passenger transport company or passenger transport services while staying within a legal situation based upon market initiative.

Selection of operators

Present how the operators are selected in your city / country:

a) Closed market
b) Competitive tendering procedures

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6 Please refer to deliverable D1 - Reference framework and harmonisation of concepts, for a more complete overview of concepts and definitions.
c) Direct competition

**Licence**: right to enter the occupation of passenger transport operator (‘operator’). A licence is granted on the basis of qualifications (concerning e.g. good repute, financial standing, professional competence) that attest the ability to be an operator. Hence, a licence concerns access to the profession.

**Authorisation**: an exclusive or non-exclusive right to operate specific services that a (licensed) ‘operator’ can apply for to a competent authority. In the case of an exclusive authorisation, other ‘operators’ are excluded from providing the same services under the same conditions. The authorisation procedure makes it possible to check whether the candidate operator fulfils all the necessary (objective and non-discriminatory) legal and administrative requirements.

**Concession**: A concession is an agreement between an authority and a (licensed) ‘operator’ of its choice whereby the authority transfers the execution of a service to the public, lying within its responsibility, to the ‘operator’ and the ‘operator’ agrees to provide the activity in return for the exclusive or non-exclusive right to operate the service or this right together with payment. A concession can take several legal forms; however, a concession is always a kind of agreement by the necessity of acceptance by the operator (although maybe very rudimentary). UK rail franchises are concessions.

Identify the role of authorities (referring to the whole government at the relevant national, regional and local levels) in terms of:

a) Control on operators (market entry, monitoring, safety)

b) Subsidisation and financing (investment, subsidies, financing, compensations)

- **Licensing authority**: to assess the compliance of potential operators with technical standards and the fulfilment of juridical requisites (i.e. granting access to the profession) in all regimes,

- **Authorising authority**: to judge the desirability of actual market entry by autonomous licensed operators (i.e. granting access to the market in market initiative regimes),

- **Concessioning authority**: to take the initiative to create a transport service concession and to select (by competitive tendering or otherwise) a licensed operator for the concession (i.e. granting access to the market in authority initiative),

- **Regulatory authority**: setting the ‘rules of the game’ for operators present on the market, together with the actual watchdog or referee monitoring and enforcing the rules of the game in all regimes,

- **Enterprising authority**: when the authority creates and bears the entrepreneurial risks on transport services she creates either by owning a public transport company (or non-corporatised internal division producing transport services) or by outsourcing the production of services she has designed. This either under authority initiative (legal public monopoly) or under market initiative (the services created by the authority have to be granted an authorisation by the authorising authority), and
- **Subsidising authority**: for two purposes: stimulate the general supply of services and redistributing wealth to politically chosen target groups in society (such as handicapped, elderly, unemployed,…).

Identify how is the allocation of strategic, tactical and operational decisions in your city / country:

a) Strategic level

b) Tactical level

c) Operational level

**STO decision making**

- **Strategic level**: strategic planning is involved in the formulation of general aims and in the determination in broad terms of the means that can be used to attain these.
- **Tactical level**: tactical planning is about making decisions on acquiring means that can help reaching the general aims, and on how to use these means most efficiently.
- **Operational level**: makes sure the orders are carried out, and that this happens in an efficient way.

Refer to the contractual and monitoring relations between actors involved in the STO decision making identified above, focusing in:

- Obligation of contractual relations
- Type of contract
- Allocation of risks

**Contractual relations**

- **Production risk**: risk associated to the production costs of a fixed production quantity, independent of the amount of passengers.
- **Revenue risk**: risk associated to the sale of transport services.
- **Gross cost contract**: in this type of contract the production risk is born by a transport company while the revenue risk is born by the tendering authority. An agreed price will be paid for the production of a fixed amount of services. Revenues accrue to the tendering authority. The difference between realised production costs and anticipated production costs is for account of the firm while the difference between actual and anticipated revenues is for account of the tendering authority.
- **Net cost contract**: in this contract both production and revenue risk are born by the transport company. The difference between anticipated total operating costs and revenues determines the price the tendering authority pays to the transport company. A realised difference between costs and revenues that does not correspond to the anticipated difference between costs and revenues is for account of the transport company.
- **Management contract**: the management contract is the mirror image of the net cost contract because in the management contract both production and revenue risk are born by the tendering authority instead of the transport company. The manager of the transport activities receives a remuneration which is (in the pure form of this contract) independent of his achievements.

Assess my performance

The second domain to assess the current situation is the assessment of the performance levels. Performance levels are naturally related with the three dimensions already mentioned:

- Productive efficiency covering the transformation of resources into transport production (productivity analysis);
- Network design, covering the correspondence between those units of transport production
and the accessibility levels in the various parts of the territory served (service supply analysis)

- Commercial effectiveness, covering the potential represented by the accessibility levels into real consumption of public transport by its clients and the revenue generated (effectiveness analysis)

For each of these dimensions a set of key indicators (KPI’s - key performance indicators) must be considered. Herewith, a short note on each of these indicators is presented, however for a full description please refer to the annex to this report.

Data collection considerations

Before starting this process, a set of considerations for data collection purposes should be taken into account:

- **Temporal frame:** Data should be collected for a time span not too short. At least ten years of data should ideally be gathered, so that trends and trend changes could be identified.

- **Longitudinal consistency is of paramount importance.** A highest possible level of reliability should be achieved, i.e. that data definitions should not fluctuate from one year to the next.

- **Geographical consistency** is in effect a sub-class of longitudinal consistency. The geographical area applied should be defined. What is covered, e.g. the area within council boundaries, or suburban areas of neighbouring municipalities? Do the operators and authorities in question cover the entire area, or a larger area? Are other operators and authorities present in the area, but not part of the analysis? These factors should be stable throughout the period examined. If this is impossible, it should in any case be stated clearly, and if possible, data should be adjusted in order to maintain consistent time series.

- **Category consistency:** By this we mean that different variables should be comparable. If ‘revenues’ cover A (i.e. all regular bus services) but not B (the airport express bus), similarly, ‘costs’ and ‘subsidies’ should also cover A, but not B.

- **Missing data:** If there is sufficient reason to believe that an underlying trend exists, interpolation or estimation based on other time series may be applied. E.g. a missing data point for passenger kilometres may be estimated by using the percentage change in the number of passengers compared to the previous year.

- **Changed definitions:** Some definitional changes may occur in the data series provided by respondents or in reports, such as inclusion of VAT, average travel length. In order to produce a consistent time series, correction factors may be applied. In general, good estimates are of greater value than bad data!

- **Quality checks:** There should be extensive quality control of data. A key element in a quality
assurance process would be to specify detailed definitions and descriptions of the various items and their components.

- **Use of indices**: Data analysis and presentation may be facilitated through the usage of indices. Assessment of changes in a given variable is easier. This would also partly address any issues of confidentiality.

- **Data collection at different levels - company, modal or LPTS**: Ideally, data should be split between different modes. This may not always be feasible, especially not with regard to items such as costs and subsidies, as overheads are difficult to define and may be arbitrarily allocated among the modes, or not allocated at all. Great care should be shown here, and all assumptions and conditions should be clearly stated.

**Productive efficiency**

Productivity concerns the ability of the local public transport systems (or individual modes/operators) in transforming inputs into outputs. This should provide information regarding how industrial performance is influenced by regulatory reform. The efficiency and productivity measures can be calculated for the LPTS or for individual modes and should include:

- KPI 1 - Seat kilometres per staff hour or unit (labour productivity);
- KPI 2 - Seat kilometres per vehicle hour (labour productivity);
- KPI 3 - Operating costs per vehicle kilometre (cost performance)

**Seat kilometres**: Figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, seat kilometres will only be reported as route data, excluding positioning kilometres. Some companies or authorities will only have data for place kilometres (i.e. capacity including the maximum number standing passengers).

**Staff hours**: Figure should ideally be divided into staff from authorities and operators respectively. Furthermore, if possible, the number of driver hours should be specified, in order to produce productivity indicators.

**Vehicle hours**: This figure should include route as well as positioning (“empty vehicle”) production, but this split does not have to be specified. If possible, data should be specified by peak hours and subcontracted hours.

**Operating cost**

- **Costs for authorities**: This figure concerns the LPTS only as a whole and does not relate to the specific modes. It should reflect the costs of administration and planning, but not the financial support granted to operators. Subsidies allocated to operators should therefore *not* be included in this figure. If possible, *labour costs* should be specified, although this figure will often be inseparable from the total cost.

- **Costs for operators** concern operators only and should be split into the following items: labour costs (=staff costs, wages) fuel/power costs; taxation on inputs, i.e. fuel taxes and other duties that are levied directly on production inputs (general tax on profits etc. should not be included); depreciation; interest; other costs (excluding taxes). Costs related to other business areas than public transport should not be included in ‘other costs’.

**Vehicle kilometres**: Figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.
Service supply aspects concern how the direct outputs of the LPTS production process are used to establish the service available to the actual and potential users of public transport, including:

- KPI 4 – Network kilometres per square kilometre;
- KPI 5 – Seat kilometres per capita;
- KPI 6 – Seat kilometres per passenger;
- KPI 7 – Seat kilometres per square kilometre

**Network kilometres (one way):** By this it is meant the number of kilometres of road and/or track served by public transport. One-way traffic systems should be treated by calculating the average of street length in both directions. This variable should not be interpreted as the sum of lines, which may be arbitrary due to line splits, weekend variations etc. Rather, the number of kilometres actually served, whether by one line or several, should be measured. The data should be divided into road (incl. tram lines in road) and track (rail, subway and separate tram lines) where possible and applicable.

**Area:** Size of the geographical area measured in square kilometres (km$^2$). It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.

**Population:** Population in the analysed area. It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.

**Seat kilometres:** The most common problem is that no information about seat kilometres is available, only vehicle kilometres. Vehicle kilometres can be used as an alternative output measure provided it can be justified that no significant changes or differences in seat capacity is present. There is likely also to be a problem in getting information about “empty” kilometres.

**Passengers:** Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, etc. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.

**Commercial effectiveness**

Effectiveness concerns the extent to which the LPTS is able to translate the potential for public transport use (accessibility) into actual public transport usage in terms of passenger kilometres/ passenger trips. Three levels of impacts involving effectiveness are specified:

- Impact on citizens’ use of public transport (measured by passenger kms);
- Impact on traffic congestion (measured through market share of public transport);
- Impact on the financial situation of the operators and authorities (measured through the revenue obtained and the subsidy required).

The three levels are interrelated and measure different dimensions contributing to the effectiveness of LPTS. It should be noted that this kind of effectiveness is closely linked to the financial performance of LPTS where public transport...
The proposed analysis will mainly focus on the usage of public transport modes to examine variations over time and between cities in terms of how good LPTS are to attract customers. This will be combined with assessment of variations in market share for public transport. The analysis of market share will indicate whether increases/decreases in public transport patronage reflect an increased or decreased share of the passenger transport market:

- KPI 8 – Passenger kilometres per capita;
- KPI 9 - Revenue per passenger kilometre
- KPI 10 – Revenue per vehicle kilometre

**Seat kilometres**: This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.

**Area**: Size of the analysed area measured in km². It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.

**Passenger kilometres**: Often calculated on the basis of an assumed average travel distance. These assumptions are in some cases somewhat arbitrary and may change over time. Therefore, these data should be carefully assessed. It could be of relevance to collect passenger kilometre data for different socio-economic groups e.g. according to age, gender, occupation and income.

**Population**: Population in the analysed area. It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis. It could be of relevance to collect population data for different socio-economic groups e.g. according to age, gender, occupation and income.

**Ticket revenue**: This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems. If aggregation is needed to calculate the revenue performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both revenue and output measures are available for the included sub-components. This means that a company with information only on revenue or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

**Welfare**

The aim of the welfare analysis is to provide information about the consequences of the LPTS production process taking into account the value of the production to the users, producers and general society, all measured in monetary terms, applying a CBA approach. This will involve the calculation of the following elements: consumers’ surplus for public transport users, producers’ surplus and externalities. The welfare measure obtained should be seen as an order of magnitude rather than a precise value due to a number of simplifications such as exclusion of impacts that cannot be monetarised.
Calculation of consumers’ surplus would require information about demand (passenger.km), generalised costs and demand elasticity. Calculation of producers’ surplus requires data concerning public transport revenue and costs. Externalities could be taken into account provided information about external costs for rail, bus and car is available (e.g. in the form of external unit cost):

- KPI 11 – Total system costs per passenger
- KPI 12 – Consumers’ surplus per passenger
- KPI 13 – Producers’ surplus per vehicle kilometre

**Generalised user costs:** Calculation of the generalised user costs requires information about: ticket revenues (to reflect the monetary cost incurred by public transport users) and total travel time costs.

**Total travel time costs:** The inclusion of travel time costs in the calculation of total system costs can be based on information on: wait time, ride time and ideally walk time. This information can be established in various ways incl.: outputs from transport models, survey work and simplifying assumptions about relations for variables available determining travel time.

**Producer costs:** The part of total system concerned with producer cost can be determined with data on: operating cost, ticket revenue and information about the shadow cost of public funds.

**Operating cost**
- **Costs for authorities:** concerns the LPTS only as a whole and does not relate to the specific modes. It should reflect the costs of administration and planning, but not the financial support granted to operators. Subsidies allocated to operators should therefore not be included in this figure. If possible, labour costs should be specified, although this figure will often be inseparable from the total cost.
- **Costs for operators:** concern operators only and should be split into the following items: labour costs (staff costs, wages, fuel/power costs; taxation on inputs, i.e. fuel taxes and other duties that are levied directly on production inputs (general tax on profits etc. should not be included); depreciation; interest; other costs (excluding taxes). Costs related to other business areas than public transport should not be included in ‘other costs’.

**Total ticket revenue:** This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

**Shadow cost of public funds:** The usage of public funds for public transport requires taxes which have a welfare distorting effect on the economy. Usually, it is assumed that the costs of public funds are 20%, i.e. 20% should be added to the net-cost in order to determine the overall resource cost to the economy.

**Environmental costs:** The environmental cost estimation requires information about unit cost per vehicle kilometre and vehicle kilometre. The environmental unit cost would normally include uncovered costs of accidents, noise and pollution costs, and costs of congestion imposed upon other actors.

**Ticket revenue:** There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, changes in accounting procedures would make comparability over time difficult.

**Travel time costs:** Collection of information about travel times may be problematic in situations with lack of appropriate transport models and/or comprehensive passenger surveys. As mentioned it is possible to establish some rough estimates on the basis of simplifying assumptions concerning the relationships between variables determining travel times.

**Passengers:** Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, etc.. Furthermore, the level of fare evasion in some
cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.
4. IMPLEMENT AND MANAGE CHANGE

4.1. Key issues to manage the change process

Key questions This chapter is organised along the set of aspects that have been highlighted in general terms in the previous chapters of this handbook. At this stage the objective is thus to provide in more concrete terms the answers to specific questions that are raised whenever a change process is undertaken, in special how to maintain the system working and performing while evolving in the change process. To proceed with that, within this chapter a “guide book” style is adopted.

Among the most relevant questions that this chapter is expected to answer, it is highlighted the following ones:

- What is a barrier? How to identify a barrier?
- Who will be affected by the LRF change? How to identify winners and losers? Who is most likely to raise barriers?
- Which are the most adequate tools to overcome or minimise the barriers’ effects?
  - At the actor level
  - At the system level
- How should authorities organise processes, while assuring performance levels during the transition period?
- How can we monitor and adapt the mobility system to meet the citizens’ needs?

Previous research on barriers The assessment of barriers has been done frequently in several projects. Such research has been developed mainly in the framework of the OECD as well as in the research programs of the European Commission. In particular it is worth to refer the analysis done in the DANTE, TENASSES, LEDA, PROSPECTS and TRANSPLUS research projects and the related events of the OECD /ECMT such as the Workshop on Overcoming Institutional barriers to implementing sustainable urban travel policies, held in Madrid in December 2000. Herewith it is not our goal to present results of those projects, but instead to provide the user with some information that enables the search for a more complete overview on the range of barriers and tools framework.

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7 Information on these projects can be found in the European Commission sites, such as [www.cordis.lu](http://www.cordis.lu), [http://www.europa.eu.int/comm/transport/extra/thematic_papers.html](http://www.europa.eu.int/comm/transport/extra/thematic_papers.html) or in the project related sites
8 [http://www1.oecd.org/cem/UrbTrav/Workshops/InstBarriers/madriddoc.htm](http://www1.oecd.org/cem/UrbTrav/Workshops/InstBarriers/madriddoc.htm)
It has become clear from previous research review that there are different approaches and different forms to assess barriers. In short we can even say that there is no single and most adequate method to analyse and classify barriers. The different classifying systems adopted in those projects are in some form saying similar things from different points of view and addressing different purposes. Indeed, as Marshal says “any classification system must be formulated and judged in accordance with the purpose of that classification”.

What is a barrier? Therefore, within the MARETOPE research, a barrier was defined as something that is causing hindrance, prevents or controls progress or movement. In an evolutionary process a barrier exists all the time, they are part of a natural cause-effect dynamic and represents always a negative effect over the evolutionary process where it is acting. They can be visible or not limiting the decision maker’s awareness and consequent action.

Barriers can also be material or immaterial and within the later it can still have a visible or hidden representation. Besides, the classification of barriers can not ignore the stage of development of the change process itself (a barrier can be more or less severe depending on the moment in which is raised and the potential political damage that can accrue) as highlighted in the figure below.

![Barrier life cycle](image-url)
Barriers are bound by the interactions between three basic elements: actors / institutions; territories and instruments. A barrier results thus from the attitude of one or several actors regarding his position in the territory (here understood as area of influence) and one or more instruments being set in the system.

In the most general sense, and as seen in the reference framework, actors may be individuals or institutions. Such variety of actors was clustered along five main actor groups:
- Public transport operators and associations
- Public authorities (transport / political)
- Citizens / customers
- Employees and trade unions
- Producers of transport means and services

As with a boomerang effect each barrier gives place to a tool that aims to mitigate the barrier but, as this occurs, a new potential is also raised that another stakeholder group might be affected by the impacts caused by the new tool (Figure 12). To some extent we can then say that there are cascade effects in this evolutionary path. For example, centralisation of transport organisation competencies in a single and supra authority can represent a tool to promote better efficiency and integration between the previous scattered segments of the PT system, but this tool could create other barriers derived from PT staff (reorganisation can determine loss of jobs) and PT operators (because of loss of powers and competencies) resistance.

![Figure 12 - Boomerang effect of barriers and tools](image)

Barriers are also dependent on the stage of development of the change process itself (see Figure 11 above), that is it can become more severe depending on the moment in which it is

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A more precise and complete description of these three elements can be found in the research project TRANSPLUS, in particular in deliverable D4.2 [www.transplus.net](http://www.transplus.net)
raised and the potential damage that can accrue.

In fact, there is a great diversity of ways to classify the different kinds of barriers, barrier types and barrier situations. Moreover, within the diverse array of barriers that can be recognised it is possible to verify that they can overlap each others, be inter-related or even nested within each other. In MARETOPE we have adopted a framework where barriers were classified according to different attributes:

- Its end target
- Its nature
- Its objectivity
- Hierarchical level where identified
- Stage of the reform process
- The hindrance and overcoming capacities

This typology is detailed in the following pages.

In terms of its end target, barriers can be classified in resource, process or framework related, meaning:

- **Resource related**
  Relates with the lack of financial, material or human resources to implement the change

- **Process related**
  Related with the change process itself, including coalition games between stakeholders

- **Framework related**
  Related with the overall environment where the change process is embedded, including the aspects related with the “rules of the game”

This interpretation seems to be well adjusted to reality if we complement the analysis of barriers by further desegregating the **consensus building levels**, taking into account the concept from the economics of institutions proposed by Williamson and Van de Velde\(^\text{10}\), where each level determines the scope of intervention of respective actors. This distinction gains importance due to the fact that tools cannot be freely established within the institutional framework, so the identification of the governance level is extremely important to

enable the correct allocation of tools. In MARETOPE the following distinction according to their nature was followed:

- **L1: cultural and social regime**
  The cultural, ideological, political and social orientations.

- **L2: legal regime**
  The laws to which public transport is submitted.

- **L3: regulatory regime**
  The general rules that are decided within the scope of the law.

- **L4: organisational forms for governance**
  The choice of organisational form by authorities and operators within the scope of the existing laws and regulations.

  - **L5: contractual relationships**
    The choice of incentives (contractual relations) between actors, within the scope of laws, regulations and organisational forms.

- **L6: allocation of resources**
  Decisions to be taken concerning conflicting allocation of budget and/or resources within the same organisation.

A hierarchy exists between these levels: they are classified with decreasing level of temporal inertia (e.g. traditions generally take longer to change than laws, which generally take longer to change than regulation rules,…). Thus, each level determines largely the scope of the next one. Besides, the analysis considers that each of the hierarchical levels has a specific context in which not all tools are equally effective. Consequently, each governance level has a possible set of tools and each tool optimises its effectiveness in a determined governance level.

Beyond the above stratification of layers of consistency – from the less formal cultural relationships (L1) to the more robust allocation of resources links (L6) – which may be used to allocate barriers and tools according to the general process of consensus building, MARETOPE succeeded in introducing several more specific classifications of barriers (and related tools) types.

Stakeholders can raise barriers when they face various types of problems. These problems can be classified into 3 different categories:
- **Capability problems** (stakeholders cannot support the change).
  
  These may concern the lack of instruments, personnel, skills, experience and competencies for the different stakeholders in order to implement the change process.

- **Information asymmetry** (stakeholders believe they cannot support the change).
  
  The stakeholders do not have enough / right information or perception concerning the reform process.

- **Conflicting interests** (stakeholders don’t want to support the change).
  
  The reform determines advantages and disadvantages for the stakeholders that react in positive or negative way.

Correspondingly to the 3 types of problems potentially encountered by stakeholders (capability, information asymmetry, conflicting interests), 3 types of barriers can be differentiated:

- **Factual barriers**
  
  These barriers are due to objectively identifiable features in the public transport regime making the realisation of its aims difficult, unlikely or illusory.

- **Informational barriers**
  
  These barriers result from a lack of information available to actors concerning the regime and its potentialities.

- **Behavioural barriers**
  
  These barriers result from subjective features in the behaviour of involved actors.

In order to determine the extent of the context affected by each barrier, 3 hierarchical levels are considered:

- **System level**
  
  Barriers affecting the LPT System as a whole.

- **Between actors level**
  
  Barriers preventing or complicating relationships between LPT actors.

- **Within actors level**
  
  Barriers affecting the organisation of an individual actor.

In order to describe the type of decisions and responsibilities affected by each barrier, 3 hierarchical levels were defined in the reference framework of MARETOPE:

- **Strategic level**
  
  The formulation of the aims of LPTS (general definition of policies, organisational forms
of the management, and transport service characteristics)

- **Tactical level**
  The precise design of transport services (routes, vehicles, timetables, fares, information...)

- **Operational level**
  The management of the resources in the field (personnel, infrastructure and vehicles)

Finally, a variable stage of the change process has been designed to identify when barriers appear relatively to the development of the whole reform process. According to this perspective, each barrier can be located at one of the following temporal stages:

- **Design**
  During the conception of plans for change covering the perception of a certain need, opportunity or threat; the definition of strategic objectives and goals; the definition of the tactical targets; the actual design and detailing of proposals; the evaluation of alternatives; and the ultimate decision-taking regarding the implementation of the proposed change.

- **Implementation**
  During the implementation of plans, e.g. the undertaking of the necessary institutional changes enabling the implementation of the desired policy measures.

- **Realisation**
  - During the stage after the implementation of plans in which the results of change become evident.

The above classifications have been combined to depict the overall context (or nature) of the barriers, highlighting in an unique scheme the attributes of the organisational framework and the change process itself. These different attributes are presented in the Table 3.
Organisational forms

Public ownership
Private concessions
Regulated authorisations
Open entry

Authority initiative
'Concessions'
Market initiative
'Authorisations'

Management contract
Own management (Dominated by private companies)
(Dominated by public companies)

Table 3 - Barriers characteristics and environment

<table>
<thead>
<tr>
<th>Nature</th>
<th>End Target</th>
<th>Hierarchical level</th>
<th>STO level</th>
<th>Stage of reform process</th>
<th>Objectivity</th>
<th>Hindrance and overcoming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural</td>
<td>Resource</td>
<td>System</td>
<td>Strategic</td>
<td>Design</td>
<td>Factual</td>
<td>Very strong</td>
</tr>
<tr>
<td>Legal</td>
<td>Process</td>
<td>Between actors</td>
<td>Tactical</td>
<td>Implementation</td>
<td>Informational</td>
<td>Strong</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Framework</td>
<td>Within actors</td>
<td>Operational</td>
<td>Realisation</td>
<td>Behavioural</td>
<td>Medium</td>
</tr>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weak</td>
</tr>
<tr>
<td>Contractual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very weak</td>
</tr>
<tr>
<td>Allocation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of resources</td>
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<td></td>
</tr>
</tbody>
</table>

Barriers interrelation

From the first assessment of case studies, it was clear that in the majority of cases there is not just one barrier causing the hindrance or delaying the situation. In general, what was identified was a sequence or set of reinforcing barriers, that is to say that barriers can have a synergetic effect. A good example is an unclear legislation – legal barrier – located outside the package of legal policies initiating the change, is causing a lack of co-ordination between institutions – governance barrier – that on its turn is causing an unbalanced LPT market – contractual barrier.

It is then assumed that barriers can be inter-related in two ways:

- As a sequence of barriers, whenever a barrier can induce other ones (Figure 13)

![Figure 13 - Sequence of barriers](image)

- As a set of barriers, when barriers are coexisting and reinforcing each other (Figure 14)

![Figure 14 - Set of barriers](image)
As already mentioned, a barrier is always latent but it is not always visible. This means that the decision maker must be aware of such reality as well as on the forms to identify the existence of a barrier (or a potential one) that can hinder the process of change even when it is not clearly visible. The diversity and complexity of the building process underlying a barrier limits the exhaustive systematisation of all possible barriers. However, one of the most effective forms to undertake such identification consists in the analysis of the reasons and motivations that can be at the origin of a future resistance\textsuperscript{11}. This analysis follows the same assumptions of the stakeholders analysis aiming to identify resistance against change, that is to assess the underlying needs and fears of the different actors.

An identical situation (or likely situation) of change can be at the origin of different individual behaviours which are related with agents’ perception, that are influenced by qualifications, aims, experiences, etc. The resistance can thus be influenced by two extremes: on the one hand a knowledge gap, i.e. caused by insufficient information about the process, and on the other an unwillingness towards the situation. This means that the quality of the available information determines consciously or not the different range of reactions from resistance to acceptance.

This process of resistance is composed by several layers of resistance as highlighted in the figure below:

- Resistance due to a wrong perception of the process;
- Rational options about the expected consequences of the process; and,
- Cultural, ideological and political opposition;

\textsuperscript{11} A more complete version of motivations behind resistance can be found in the MARETOPE report D6 - Barriers and Tools to assist key players in the process of change
As mentioned above, knowledge and willingness regarding a change situation represent the two extremes of the resistance spectrum. Based on those poles a further desagregation of the types of resistance can be performed. Such generic types of resistance reasons are respectively:

<table>
<thead>
<tr>
<th>Resistance because</th>
<th>Resistance because</th>
<th>Resistance because</th>
</tr>
</thead>
<tbody>
<tr>
<td>- insufficient information</td>
<td>- supposed personal disadvantages</td>
<td>- missing will</td>
</tr>
<tr>
<td>- lack of understanding</td>
<td>- awaited negative economic impacts for the organisation</td>
<td>- Ideological differences</td>
</tr>
<tr>
<td>- unclear regulations</td>
<td>- increased market risk</td>
<td>- lack of co-ordination</td>
</tr>
<tr>
<td>- different</td>
<td>- missing capability</td>
<td>- lack of visions</td>
</tr>
<tr>
<td>- interpretations</td>
<td>confidence</td>
<td></td>
</tr>
</tbody>
</table>

Person have not understood the aims and backgrounds of the change process | Lack of information | Lack of clarity |
---|---|---|
Person have understood the aims and backgrounds but do not believe them | Lack of information | Lack of confidence |
Person have understood but are not able and willing because of no positive consequences | Lack of will | Lack of competencies |
Person have understood but they are waiting negative consequences | Lack of will | Lack of compensations |

Who will be affected by the LRF change? | As already referred any change process causes positive and negative impacts on the different stakeholders. It is thus important to identify at the outset who will be the winners and the losers, as the last ones will likely be the promoters of barriers.

How to identify winners and losers? | The previous analysis of these effects enables to conceive mitigation measures so that opposition can be smoothened or even removed. It is also worth to refer that the loosing effect is not only economic but can be also social and also a second level effect.
What is a Tool?

Within MARETOPE a tool is an instrument used either to mitigate or fully neutralise a barrier. Tools are not born naturally from the interactions between agents, they require analyst and decision making specific intervention.

A tool is thus anything used to overcome or minimise the effect of an hindering or delaying situation within the change process. Similarly to barriers, tools can be classified according to different environment and characteristics, as illustrated in Table 4. Once the categories reflect the same logic as the one of barriers its explanation is omitted.

<table>
<thead>
<tr>
<th>Nature</th>
<th>Hierarchical level</th>
<th>STO level</th>
<th>Stage of reform the process</th>
<th>Objectivity</th>
<th>Effectiveness</th>
<th>Main tool classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural</td>
<td>System</td>
<td>Strategic</td>
<td>Design</td>
<td>Factual</td>
<td>++</td>
<td>Process tool</td>
</tr>
<tr>
<td>Legal</td>
<td>Between actors</td>
<td>Tactical</td>
<td>Implementation</td>
<td>Informational</td>
<td>+</td>
<td>Resource tool</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Within actors</td>
<td>Operational</td>
<td>Realisation</td>
<td>Behavioural</td>
<td>0</td>
<td>Framework tool</td>
</tr>
<tr>
<td>Governance</td>
<td></td>
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<tr>
<td>Contractual</td>
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<tr>
<td>Allocation of resources</td>
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</table>

Table 4 - Tools characteristics and environment

However, it is relevant to evaluate how we can assess the effectiveness of tool, so that a decision could be made in accordance with it.

The effectiveness of a tool are then dependent on three dimensions:

- The easiness of tool implementation, i.e. does the tool take too much time to implement, is it resource consuming, does it implies profound changes;
- Interrelation between different tools (synergetic effects), i.e. the tool can induce other tool, or the tool can coexist and reinforce the potential of another one; and,
- Effectiveness in solving the hindering and delaying set or sequence of barriers.

How barriers and tools are inter-related?

A specific aspect of the development of tools is related with the logic of relations between barriers and tools, that is distinguishing between barrier individual tools and global tools.
Within the first type (barrier individual tool) of tools we can distinguish those directly targeted to an individual barrier and a tool that can contribute to overcome several barriers.

The second type of tools (global tools) can be understand as an enlargement of the first type. From the experience of Maretope case studies it is interesting to notice that these overall tools are those that are recognised and described.

Overall tools can be subdivided in two kinds of overall tools. The first possibility is an overall tool that can be defined as one tool, however the identifiable subparts of the tools overcome the different individual barriers of the existing set and or sequence.

For example, in some of the cases where competitive tendering regime has been introduced, declining working conditions (governance) and service quality (contractual) could be observed. This may on the one hand induce difficulties in driver recruitment (governance); on the other hand, such examples could reinforce the opposition to tendering regimes (cultural). The protection of workers’ rights (cultural and social tool) can be considered a key global tool contributing to overcome these barriers. Sub-tools such as clauses in contract to prevent wage dumping may be applied.

The second possibility is a clearly single overall tool that can be used to overcome the overall set and or subsets of barriers. The latter is visualised in the following figure.
For example, a barrier sequence exists as stakeholders try to preserve the advantageous status of current operators, thus resulting in unfair competitive regulation in favour of incumbents (regulatory). The global tool here is to align the operators as much as possible in terms of cost levels (where some operators are at a disproportionate [dis-]advantage) and information (where there is an adverse information asymmetry).

Which are the most adequate tools to overcome or minimise the barriers’ effects

From the outset it was clear that MARETOPE is not supposed to provide a single solution to the problems. On the opposite way we are expected to highlight from the analysis and research undertaken which were the different alternatives that have been promoted and leave the decision to follow them or not to the reader.

As such, in the following pages the reader will obtain a synthetic overview on the most adequate tools as they were applied in the selected MARETOPE cities. This means that in the context analysed they seem to be the adequate ones, however in different contexts they could not result.

A further division of tools results from the level in which they will mainly focus, that is we can distinguish the tools mainly target to act at the actor level and the tools designed for the system level. If in the first group tools are orientated to assist key players in the process of change, in the second case the main focus is devoted to the issues related with the opportunities to undertake institutional restructuring, steering functions, etc.

Tools at actor level

In what concerns the tools mainly orientated towards the actor level, the research revealed the application of tools mainly to overcome cultural and social, legal, regulatory, governance...
and contractual barriers. In more detail:

Among the tools to overcome cultural and social barriers it is distinguished

- the ones related with the opposition to competitive regimes.

  A frequent barrier highlighted in the cases studies consists in the opposition of staff and unions to tendering regimes. In some cases such opposition is also visible on the side of operator and some administrations are also opposing. To overcome this type of barrier, a frequent tool consisted in the protection of workers’ rights and/or wage levels, the promotion of a more direct dialogue or even the better integration of unions in the process. No clear tools to overcome operator resistance have been reported, however the gradual introduction and stepwise implementation processes seems to be quite common. The opposition of public administration is naturally more difficult to overcome, and often requires political measures conducting to legal changes.

- the ones related with the lack of political will to implement the reform.

  In several cities it was noticed a general lack of will to go ahead with the reforms, which are due to the existence of other political concerns of higher priority or from disagreements and/or contrasting aims between different stakeholders. In general there are few tools to overcome such situation, however experiences of national support to cities seems to be successful. The existence of disagreements between stakeholders tends to be solved mainly through the promotion of long term plans, more transparency and openness of the process to all.

- the lack of skills and experience.

  The lack of technical and commercial culture is often referred as a barrier to handle the change processes. Among the tools that have been reported, the designated training programmes to promote commercial skills seem to have some success.

Tools to overcome legal barriers are mainly orientated towards.

- the overcome of unclear legal framework.

  Frequently a lack of clarity of the current LPT legal framework is reported as a barrier. No specific tools have been found to overcome such barrier, however some solutions such as high level consultations, external legal advise have been mentioned.

- the overcome of financial instability.

  In several cases the financing systems established within the legal framework are limited to year by year subsidisation and management, making more difficult a long term plan. Increasing funding, longer term contracts and the inclusion of performance contracts have been reported as possible and successful tools.
• the overcome of conflicts with EU legislation

The potential conflict of national subsidisation regimes and the forthcoming EU legislation was noticed as barrier. No specific tool was mentioned to overcome this barrier, however the development / adaptation of the legal framework in line with such requirements was initiated.

Barriers at regulatory level and respective tools were mainly reflected in terms of:

• to overcome market failure and competitive problems

Several cases reported the non existence of a perfect competitive market which results in a lack of competitors, monopolistic or oligopolistic situations in the market. Conflicts of interest resultant from the authority role as shareholder or wrong an ineffective selection criteria have also been reported.

Lack of competitors is a difficult barrier to overcome and no tools were identified to overcome it, as even in countries where competition is already in force for longer periods, the number of competitors remains scarce.

Some tools to avoid oligopolistic situations includes the promotion of measures so that municipal operator fit for competition, other measures aim to attract smaller operators to maintain competition. Few tools have been designed to overcome conflicts of interest, but the solution seems to be the restructuring of such relation either through giving the operator a different legal structure or privatising it or selling it to a third party.

• to overcome unfair competition

Cities where tenders have been introduced refer to unfair competition, mostly in favour of the incumbents thus putting the new entrants in disadvantage.

The tools above mentioned could also be used in this situation, however the cases analysed reported experiences with the exclusion of the municipal companies from the early stages of transition, and other reported experiences with subsidy reductions and/or price adjustment aligning public and private operators.

• to overcome external factors

The increase of car usage and consequent decreasing of PT market share is a barrier frequently reported in case studies, although not easily affected by a regulatory change.

Tools to overcome these type of barriers, although outside the analytical scope of MARETOPE, refer to increasing investment levels, improvements in service integration, marketing initiatives, among others.

To overcome regulatory barriers

Identified tools to overcome governance barriers include the following actions:

• to overcome unclear definition and allocation of responsibilities

Cities have reported the fact that unclear roles of authorities and operators are at the
origin of further problems in terms of competencies and responsibilities. The planned or realised institutional restructuring involving a clear allocation of tasks and responsibilities as well as the establishment of PTA centralising responsibilities were among the tools reported as with successful implementation.

- to overcome lack of authorities’ influence
  A frequent problem mentioned is the non existence of an effective control over the LPTS either because the law limits their influence or because they do not exert enough power on LPT operations and planning.
  The above mentioned tool of PTA establishment and the restructuring actions conducting to a clarification of roles and responsibilities were classified as successful tools to overcome these type of situations

- to overcome human resources related problems
  One barrier referred to by the PTO is the difficulty in the management of their personnel. Staff recruitment is sometimes difficult. The fact that potential employees be mainly attracted by the public owned companies offering higher and better conditions than the private ones is also referred to.
  Some of the relevant tools have already been highlighted as tools to overcome cultural barriers. A key aspect to overcome this difficulty and to improve the attractiveness of the job, consist in the protection of worker rights and wage levels.

Finally in what concerns the tools to overcome contractual barriers they are reflected at the level of:

- to overcome insufficient financial resources
  Such type of barriers is mainly related with the discrepancies that are often existent between service requirements and the available funds.
  Among the general tools successfully reported is included the cost reductions or restructured financing. Cost driven subsidy took place in several cities. Also tariff integration and improvements in service quality have been applied.

- to overcome too strict contractual negotiation framework
  Barriers at this level refer to the rigidity of the negotiation ad planning system which leads to lack of freedom during the negotiation stages.
  Common tools included long term contracts, some clauses variations. The dispersion of tenders across time and the extension of original contracts were also reported as a successful tool for such type of barriers.

- to overcome unclear contracts
  No specific tools rather than the improvements in the actual contracts, through more
precise definitions on requirements have been indicated.

- to overcome adverse impact on quality

In some cases where competition was introduced an adverse impact on quality was reported, including decline in vehicle and infrastructure quality, among others.

Quality partnerships, direct regulation, incentive and performance contracts are among the tools successfully reported to overcome such barriers. Also monitoring and benchmarking tolls have been reported.

At the System level, there is a strong lack of tools, which hinders the consistency of the change process across the different governance levels and also sectorial levels as wider integration is expected as a result of the change process. Among the tools which are found to be more necessary we could find:

- Information systems with harmonized data collection methods;
- Innovative methodological techniques for cross city comparison, enabling a better assessment of transferability
- Detailed methods to analyze the effects of integration
- Tools to address inter-institutional dynamics, entailing a better understanding of strategic options of the different actors when confronted with change movements.
5. **Conclusions & Recommendations from MARETOPE Research**

5.1. **Research issues**

Key findings

A main rationale for the recent and on-going regulatory reform initiatives of public transport in Europe is the possible scope for improvements in performance. This holds in particular regarding productivity and cost, but also wider aspects linked to the position of public transport in the travel market as a contribution to sustainability in urban areas are put forward.

Therefore, it is of utmost importance to understood how regulatory factors are linked to public transport performance. This includes identification of regulatory structures that appear to represent optimal conditions for public transport performance. In addition, it is of significance to assess how the various stakeholders associated to the local public transport are influenced by regulatory reform initiatives in order to address problems linked to the implementation of reforms caused by low degree of acceptability at stakeholder level.

Traditionally, empirical performance analysis has focused on issues of productivity and (mainly technical) efficiency mainly determined by the viewpoint that first priority for public sector activities are to operate technically efficiently. Our research has expanded on the areas of performance analysis by looking beyond technical efficiency and productivity into economic welfare implications.

Furthermore, the analysis undertaken also addresses the lack of public transport performance studies involving comparative international perspective. Most studies involve comparison of public transport within a given country. In this analysis, performance of public transport systems has involved a sample consisting of cities from a number of European countries.

The research also adds further information concerning the role of contractual design on public transport performance. So far, there have been too few empirical studies examining the impact of contractual arrangements (De Borger et al, 2002). In particular, the analysis has considered the influence of risk allocation on productivity and efficiency. Further research is though required to provide information about other aspects of contractual design.

Finally, the explicit consideration to the perspectives of each of the key stakeholders associated with public transport allows for a comprehensive assessment of the implications of
regulatory reform initiatives with reference to the situation in the selected case studies.

5.2. Impact Analysis

Overall impacts

The following dimensions of performance have been analysed: Labour productivity, cost performance, technical efficiency, service supply, market effectiveness, total system and economic welfare. In addition, an overall assessment of individual case studies has been undertaken. Although the results are exploratory (in the sense that they refer specifically to the selected case studies) some interesting findings have been obtained. Below, these findings are briefly summarised:

- Labour productivity: results seem to indicate that public ownership has a negative effect whereas existence of competition has a positive effect. These results hold both with respect to LPTS level and modal level.
- Cost performance: results suggested that cities where operators bear production and/or revenue risks have significant lower unit costs compared to other cities. It was found that public ownership indicated slightly lower costs, while existence of competition indicated slightly higher cost (neither results are statistically significant). These counter intuitive results appear to be caused by the inclusion of some Southern and Eastern European cities with substantial lower labour costs combined with mostly public ownership and lack of competition in the public transport market. It should be noticed that these results are found at LPTS level but not for bus only.
- Technical efficiency: results seem to indicate that public ownership has a negative effect whereas cities where operators bear production and/or revenue risks have higher efficiency compared to other cities.
- Service supply: the results suggest that cities with publicly owned operators and/or tendering have a higher level of service density (measured as mln vehicle kilometres per km²) compared to other cities.
- Market effectiveness: the estimated demand model provides a good explanation of public transport demand through inclusion of standard explanatory factors such as fare, average per capita income and service level. However, the estimated model does not specifically include variables concerning organisational or regulatory variables, as none of them are significant. This implies that their influence is more indirect working through the included explanatory variables, e.g. regulatory and organisational factors could have an influence on both service level and fare levels.
- Economic welfare: the findings suggest that small and medium cities generally perform
better in terms of consumers’ surplus per capita, producers’ surplus per vehicle kilometre and welfare per capita. Overall assessment: results suggest that cities that have introduced competitive tendering have the largest positive increase in public transport efficiency. This is likely to be partly linked to the reduction in number of employees often occurring when regulatory reforms are introduced, although the social cost of unemployment is not taken into account. At this stage, we can thus conclude that competitive tendering has a positive influence in efficiency even if its dimension can not be assumed.

Although these results are far from being clear-cut conclusions concerning the influence of regulatory factors (e.g. public vs. private ownership, competition vs. no competition) but they do provide some indications which can establish the starting point for more detailed analysis within each case study city. This highlights an important role of performance analysis to be used as a dialogue instrument for individual cities to re-assess the organisation of local public transport services.

This analysis should include both quantitative and qualitative elements.

Stakeholders perceived impacts and acceptability

Impacts are differently perceived by the various stakeholders, as each one is affected in different ways by the reform initiatives. The impact assessment was made against three main dimensions: economic, financial and social/quality of life. The analysis revealed a consensus within each stakeholder group, although the group representing PT staff is the one with the highest degree of consistency.

An overall analysis across the case study cities indicates that acceptability and impacts perceived are strongly related to the type of reform being implemented/discussed, although it is not possible to provide exhaustive conclusions about the three types of reform. This limitation is mainly due to the existence of other impacts, which can not be isolated. However, a key concern across the case studies is the implications of introducing competition. It seems that in general stakeholders are more concerned about reforms involving more competition than organisational reforms. However, some cases (e.g. Oxford) suggest that it is possible to establish a system with tendering and open entry without some of the negative impacts perceived by the different stakeholders, if mitigating measures are adopted in advance. The fact that some reforms are still in the early stages leads to some uncertainties about the process. In fact, the need for reforms is not the main problem as in general all groups accept...
it. The main concerns are raised regarding the process itself and the underlying fears concerning the future which are influenced by how far in the reform process the city has reached or for how long the reform has been in place. If reform plans have only reached the initial stage of design and development the acceptability of reforms are likely to be very limited compared to the situation where a reform has been fully implemented. However, this relation is not clear-cut, as it is possible that changes influencing public transport may take place in anticipation of the reform itself.

**Summarising** Public ownership seems to be associated with increased operating costs and reduced productivity. Competition, particularly in the form of tendering has the reverse effect leading to reductions in operating costs and increased productivity. There was some weak evidence to suggest that for the bus industry gross cost tenders (in which the operator bears only the production risk) may be more effective than net cost tenders (in which the operator bears both the revenue and production risk).

Our analysis also suggests that net cost tenders may be more appropriate in the rail industry (possibly because the greater proportion of off-vehicle sales permits a greater degree of price discrimination) In general, we have found regulatory reform to be welfare enhancing although there may be specific instances where this is not the case, in particular in transition periods.

With respect to efficiency in terms of consumption, we were unable to detect any strong effects other than tendering was associated with increased service levels per unit area. Overall, our conclusion is that in general the impact of regulatory reform on efficiency in terms of consumption is neutral.

**MARETOPE pitfalls** One of the reasons that might contribute to explain the previous conclusion relates with the fact that in the majority of observed cities the change process was only recently started and in some others not even implemented. This causes a considerable lack of maturity in the process itself and consequently effects can not be properly assessed. A reservation is thus needed on the conclusions taken at this stage. However, the added value of the research lies in the provision of methodologies that can be used at a later stage when time gap is sufficient to produce effective effects. Furthermore, additional research should extend the analysis to other cities to assess whether the results obtained in this study can be replicated in other urban areas with similar regulatory structures, i.e. consideration to external validity.
The analysis of the 31 case studies of the MARETOPE research has provided a wide-ranging set of results. These findings will be useful to the involved case study cities. However, in order to enhance the applicability beyond the MARETOPE case studies it is necessary to consider the issue of transferability.

On the basis of the assessment of transferability specific advice concerning regulatory reform should be identified. The available case study information provides a range of possible indications, including the following issues:

- Performance seems to be lower for publicly owned operators than privately owned operators.
- Competition (in the form of tendering or open entry) seems to enhance performance of local public transport systems.
- Risk allocation towards operators (either production or revenue risk) can enhance productivity and efficiency.
- Service supply seems to be higher in those cases where the dominant operator is publicly owned.
- Public transport demand seems to be only indirectly related to regulatory reform, e.g. the effects appear to be through changes in fares and/or service level.
- Welfare seems to improve with introduction of competitive tendering for public transport services.
- Regulatory reforms have not had significant impacts towards sustainable development, or at least it cannot be measured. This is consistent with earlier findings that in order to reduce car travel direct measures such as road user charges are required.
- The biggest opposition towards regulatory reform is likely to come from public transport employees and trade unions.
- Stakeholder acceptability is likely to be higher for organisational-based (or capital market) reforms rather than competition-based (product market) reforms.
- Substantial problems can be experienced with respect to public transport reforms without consensus among stakeholders or at least a degree of acceptability.
5.3. **Recommendations**

5.3.1. **Performance analysis**

General recommendations

The impact analysis has illustrated the problem represented by lack of appropriate data for variables used in the performance analysis. Lack of appropriate data could either involve no data at all for a given variable or poor data (e.g. due to incomparability). Therefore, it has not been possible to include all cities in the analysis of the various performance indicators. This suggests the need to identify and present a spectrum of solutions for performance assessment, where for some variables a full analysis can be made, for other proxies have to be developed. This is graphically presented in the figure below:

<table>
<thead>
<tr>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
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</thead>
<tbody>
<tr>
<td>Good data</td>
<td>Partial good data (other missing)</td>
<td>No data</td>
</tr>
<tr>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Full analysis</td>
<td>Full analysis + Proxy</td>
<td>Very rough proxy</td>
</tr>
</tbody>
</table>

In MARETOPE this has been taken forward by presenting three broad groups of approaches for each performance dimension considered: an ideal approach, intermediate approaches (mostly the ones used our research) and approaches to be used when data are either missing or poor. The following table provides an overview of the possibilities suggested:

<table>
<thead>
<tr>
<th>Productivity, efficiency, cost performance</th>
<th>Ideal approach</th>
<th>Intermediate approaches</th>
<th>Approaches with poor or no data available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service supply</td>
<td>Frontier models (e.g. Data Envelopment Analysis and stochastic parametric models)</td>
<td>Partial productivity ratios, average production functions</td>
<td>Expert judgements</td>
</tr>
<tr>
<td>Market effectiveness</td>
<td>Detailed modelling of accessibility based on zonal data</td>
<td>Service supply indicators, e.g. vkm/area, vkm/pop</td>
<td>Expert judgements</td>
</tr>
<tr>
<td>Economic welfare</td>
<td>Analysis based on modal shares</td>
<td>Public transport demand modelling</td>
<td>Rough proxies such as car usage, car ownership</td>
</tr>
<tr>
<td>Overall assessment</td>
<td>Computable General Equilibrium models</td>
<td>Estimation of total system costs, calculation of consumers' and producers' surplus</td>
<td>Expert judgements</td>
</tr>
<tr>
<td>Stakeholder assessment</td>
<td>Multicriteria Analysis</td>
<td>Appraisal Summary Tables</td>
<td>Expert judgements</td>
</tr>
<tr>
<td></td>
<td>Comprehensive and in-depth interviews with all stakeholders</td>
<td>Comprehensive and in-depth interviews with selected stakeholders</td>
<td>Expert judgements</td>
</tr>
</tbody>
</table>

*Table 5 - Spectrum of approaches for the Impact Analysis*
5.3.2. Improvements

Data Collection

The following recommendations are done in order to overcome the pitfalls related to data collection.

Short term improvements

- Provision of data for all cities
  Most cities do not have information on staff numbers and labour costs, which is an important factor to assess the effects of competitive tendering.

- Promotion of quality output
  A comprehensive description of outputs from public transport should be extended to cover quality characteristics. This could utilise the framework put forward in Hensher and Prioni (2002), where a generalised service quality index is constructed based on the concept of customer satisfaction and providing extensive information on customer profiles and preferences.

- Interviews with passenger groups
  These interviews should provide more details regarding passenger perceptions of regulatory reforms and their impacts.

Long term improvements

- Extension of sample
  A larger sample would enable more robust performance analysis to be undertaken. In particular, this could allow analysis of performance in different sub-samples. In this way, the problems associated with non-comparability from city characteristics, operational practice or network characteristics could be addressed.

- Detailed field studies of performance impacts, combined with interviews
  An important improvement would also be to combine the desk research of performance to field studies and interviews. The first part would concentrate on the measurement of performance through detailed analysis of operational practice. The second part would focus on understanding the factors that have influenced performance, discussions with authorities and operators about the findings, and identification of possible initiatives to improve performance. It should be noticed that such a study would only be possible to undertake for individual cities not as part of a 31 cities’ sample.

- More detailed interviews with all stakeholder groups
  These interviews would be dedicated to determine in-depth perceptions of past changes and likely future scenarios and their linkage to regulatory reform.
Methodological aspects  Methodological improvements in areas of impact assessment includes:

- **Productivity, efficiency and cost analysis**

  Recent studies have shown the capabilities using a frontier based approach in the analysis of public transport performance. In WP3 frontier approaches have been included covering both parametric and non-parametric methods. However, the application of these methods has been limited by data availability. In particular, the presentation of the ideal approach highlighted the advantage of developing stochastic non-parametric methods combining the advantages of the stochastic parametric methods and the deterministic non-parametric methods. In principle, this could be approached from two directions: (1) parametric methods with more flexible functional forms, (2) non-parametric methods where stochasticity is introduced (e.g. chance constrained programming).

- **Service supply**

  The analysis of service supply concerns the transformation of the outputs (vehicle.km) into the service that public transport offers to the citizen considered through the concept of accessibility. The first option proposed is to define accessibility for a given zone of origin and for a given time threshold as the “total mass of destinations within the urban area that can be reached within that time travelling from that zone, based on public transport plus walking”, and including consideration for waiting time and transfer times in relation to frequency of service. Mass of destinations here corresponds to the number of inhabitants and workers in each zone, plus the daily number of visitors or clients that each facility located in that zone, taken as a potential destination, attracts. An alternative possibility within the same general definition of accessibility, is to use as mass of each destination zone (as “seen” from each origin zone) the number of trips with that origin and destination, as represented in the O/D matrix for all motorised modes. The matrix for all motorised modes should be used, not the one only for public transport, as doing this would reduce the weight of zones badly served by public transport from the origin being considered. This alternative definition requires that an O/D matrix be available, but probably reflects better the preferences for interaction between city zones, instead of summing them all up equally.

- **Market effectiveness**

  Models explaining market share of public transport by destination zone as a function of cost of parking, and the relative accessibility of public transport to accessibility of private transport, should be used for a better estimation on market effectiveness.

- **Economic welfare**
Computable General Equilibrium (CGE) models represent a possible solution to the problem of partial equilibrium analysis. A CGE model for an economy is based on utility functions for consumers (or groups of consumers) which determine demand functions and production and cost functions for specific goods or groups of goods combined with computational algorithms to determine equilibria. These models have the potential to examine the implications of transport policies on the economy through the changes in transport costs where the model computes the new equilibrium with all variables for the economy determined (including output, input levels and income).

- **Overall assessment**
  Overall assessment based on consideration of multiple criteria. If weights are available (established from decision-makers preferences) the assessment could be used within a formal multicriteria analysis (MCA), as outlined in the EUNET MCA methodology\(^1\).

### 5.4. Barriers & tools

#### 5.4.1. Barrier environment

<table>
<thead>
<tr>
<th>Key aspects</th>
<th>Key aspects from barriers &amp; tools assessment</th>
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<tbody>
<tr>
<td>The overview of lessons about barriers and tools to overcome the process of change presented in the previous chapters has highlighted strength and weaknesses of different regulatory strategies – closed market, controlled competition, deregulation – in relation to their implementation as well as their design.</td>
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</table>

Regulatory and market solutions should be always considered in all their varieties and with all likely deficiencies and side-effects if true comparisons are to be effected. However, in the case of local public transport systems is difficult to escape from the general impression that regulation practice as a whole suffers from some more basic drawbacks, more or less common to many different situations, as compared to other markets and public utilities (e.g. telecommunication, electricity, gas etc.). The latter, more often than not, have seen profitable markets to grow, even if not always the outcome has been achieved of a real competition, with the expected benefits for consumers. But in local public transport there are still paradoxical situations, in which operators are obliged to compete for “loss making” markets, where the share of consumers – public transport passengers – is continuously shrinking.

This paradox is usually considered an almost obvious consequence of the fact that urban

\(^1\) For more details please consult the annex to D5 report.
public transport, to face the challenge of the competition and negative external effects coming by the growing car use and congestion in our cities, as well as the need to pursue positive external effects of more dense and frequent services (the so called Mohring effect), is always characterised by lower ticket revenues than costs. But to determine the level of network subsidies which could ensure the efficient operation of the market is far from being trivial. We think that this aspect is often left on the background if not totally neglected in the current debates on the LPT regulatory reform, and it should come to fore in some way.

An important drawback of any LPT process of change probably comes from seeing it as a separate process, not included into a broader process of urban transport regulation, which should imply to regulate the use of private cars in the urban context in order to achieve sustainable transport goals. The other public services – e.g. electricity, gas, water – require the customers to be physically connected to a network infrastructure, to access services supplied by the operators, while the possibilities that self-production activities (e.g. self-production of energy). On the contrary, in the urban transport context, a strong and often more convenient “self-production” substitute of public transport services is the private car. Therefore, the competition playground to be addressed by LPT regulation should be that between public transport and the automobile, not only within the public transport sub-system, and we can even say that:

Any process of change of public transport which promise to reduce costs by one side, and increase the output and quality of the service by the other side, should be considered in an urban context where the market power of the private car – which comes from the superior utility that cars offer to their users in many respects (e.g. flexibility, comfort, lower time and money costs in several circumstances) – is regulated. The evidence of failure caused by the lack of a coherent regulation of urban transport as a whole is congestion, which happens especially in the larger cities, and when occurring reduces the performance of both public and private transport, and the total utility of transport users.

This statement will be explained bringing some arguments in favour of adopting a more broader view of regulation of LPT systems, and developing tools which go beyond the strict boundaries of public transport operation, to include wider urban planning and regulation policies.

What is Whenever the goal is to search a better regulation of LPT systems, widening its scope to
Regulation of urban transport at large, is worthwhile to look again at the fundamentals of regulation. Following the relevant literature (see Baldwin & Cave, 1999), it is perhaps useful to think of the word regulation being used in the following different senses:

- **As a specific sets of commands** – where regulation involves the promulgation of a binding set of rules to be applied by a body devoted to this purpose.
- **As a deliberate state influence** – where regulation has a more broad sense and covers all state/public authority actions designed to influence industrial or social behaviour. Thus, command-based regimes would come within this usage but so also would a range of other modes of influence – for instance those based on the use of economic incentives (e.g. taxes and subsidies); contractual powers etc.
- **As all forms of social control or influence** – where all mechanisms affecting behaviour – whether these be state derived or from other sources – are deemed regulatory.

Regulation is often thought of as an activity that restricts behaviour and prevents the occurrence of certain undesirable activities (a “red light” concept) but the influence of regulation may also be enabling or facilitative (“green light”) as, for example, where the airwaves are regulated so as to allow broadcasting operations to be conducted in an ordered fashion rather than left to the potential chaos of an uncontrolled market.

The narrow definition of regulation, in the first bullet point above, individuates what strictly are the so named **regulatory measures**, responding to a “red light” concept. The broader definition of the second bullet point can be equated to the concept of **regulatory framework**, where the state/public authority plays a central role and regulation is achieved often through a mix of red and green light measures. Finally, we can use the word **regulatory context** for the definition of the third bullet point, to include not only the framework of rules and actions which stem from the public authority, but also other sources which contribute to regulate the system behaviour (e.g. markets, non-governmental organisations etc.).

**Enlarged regulation versus LPT regulation**

Why an enlarged regulation of Urban Transport should be more effective than LPT regulation only?

MARETOPE has studied several examples of LPT regulatory frameworks and their processes of change. These regulatory frameworks typically include set of rules binding the behaviour of public transport authorities and operators, at the strategic, tactical and planning level, but are not deemed to include other ancillary measures which influence the urban transport system.
(e.g. land use planning and development, road or other forms of car pricing or access regulation etc.). Although the relevance of these other measures affecting the urban transport context is recognised, they are taken as exogenous to the LPT regulatory framework.

But the rationale for regulating LPT cannot be separated by that for regulating urban mobility as a whole, without lessening the effectiveness of the LPT reform process itself. To explain this remark, we should look for a while at the rationales for regulating, and then discuss the specific implications we see for LPT.

Indeed, many of the rationales for regulating can be described as instances of “market failure”. Regulation in such cases is argued to be justified because the uncontrolled market place will, for some reason, fail to produce behaviour or results in accordance with the public interest. Among all the possible technical justifications to advocate regulation, only those particularly relevant in relation to transport will be shortly described below. Each description is followed by the discussion of specific implications for LPT regulation.

Which implications?

Monopolies and natural monopolies: as it is well known, monopoly describes the position in which one seller produces for the entire industry or market. Monopoly pricing and output is likely to occur and be sustained where three factors obtain: i) a single seller occupies the entire market; ii) the product sold is unique in the sense that there is no substitute sufficiently close for consumers to turn to; iii) substantial barriers restrict entry by other firms in the industry and exit is difficult. One response to potential monopolies is to use competition or anti-trust laws so as to create a business environment conducive to competition. Where a “natural monopoly” exists, however, the use of competition law may be undesirable. A natural monopoly occurs when economies of scale available in the production process are so large that the relevant market can be served at the least cost by a single firm. If a firm is in a position of natural monopoly then, like any monopoly, it will present problems of reduced output, higher prices, and transfers of wealth from consumers to the firm. Restoration of competition is not, however, an appropriate response since competition may be socially costly and thus regulation of prices, quality and output as well as access may be called for. Not all aspects of a supply process may be naturally monopolistic. Instead, the economies of scale phenomenon may affect only one part of a given process – for instance the transmission of,  

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14 Baldwin and Cave, 1999, list the following technical justification for regulating: 1) monopolies and natural monopolies; 2) windfall profits; 3) externalities; 4) information inadequacies; 5) continuity and availability of service; 6) anti-competitive behaviour and predatory pricing; 7) public goods and moral hazard; 8) unequal bargaining power; 9) scarcity and rationing; 10) distributional and social policy; 11) rationalisation and coordination; 12) planning
say, electricity, rather than its generation. The task of many governments and regulators should be to identify those parts of a process that are naturally monopolistic so that these can be regulated while other aspects are left to the influence of competitive forces.

Implications for LPT regulation: the claim that “de facto” monopolies of public transport are not “natural” monopolies is at the basis of many LPT reforms spurring competition among different transport operators. But this claim should be better circumstaniated looking at the overall process of urban transport, to identify and separate those parts that are naturally monopolistic – road, rail and metro infrastructures – from the production of transport services which use the infrastructures. A coherent LPT regulatory framework should firstly separate the management of infrastructures from the production of services whenever these are vertically integrated. The former should be subject to access pricing and quality control measures, while the latter should be open to competition. This concept is well known and applied in the rail sector, but it is difficult to implement in the urban context, and particularly in large cities. Here one should identify as essential facilities for transport service operation not only the metro and/or light rail lines, but also specific facilities for bus services (e.g. deposits) and the road infrastructure, which is shared by bus services, other services (e.g. taxis) and private car traffic. In particular the road infrastructure is usually financed from the general budget and geared separately by the public authority, while it could result more rationale to finance the fixed costs of urban roads – especially whenever these are heavily used in the most dense urban areas – with appropriate access regulation and pricing schemes for Public Transport and private vehicles. These schemes should allow, for instance, PT prioritisation, differentiated pricing of private vehicles and even use of revenues from private car pricing to finance PT infrastructures or to substitute current network subsidies schemes, which are also financed from the general budget (often heavily constrained by problems and trends of public expenditure reduction). However, the rationale to use revenues from private cars to

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15 To analyse in detail this effect is beyond the scope of this report, but the reader can refer to Oz Shy, 2001, Chaper 9 for a more complete description
16 In the case of land transport, the linearity of air connections is obviously forgiven, and it is less easier to observe the hub-and-spoke effect. However, an impressive evidence of this can be seen in the Island of Malta, where there is a long standing tradition of privately operated buses. Nowadays, is still a family business, where the single households hold the licence to operate their own buses on specific routes. The PT network is a pure hub-and-spoke system, with all the lines converging in the capital city, La Valletta, without tangential PT connections. The volume of commuters going to La Valletta daily is high, and this allows the PT fares to be maintained relatively low, especially as compared to taxi fares (taxi is the only transport service connecting the other cities of Malta directly). Recently, economic and other activities are sprawling out of La Valletta, and commuter patterns are less concentrated, but the star-like PT network is not able to respond to the new demand of tangential trips. As a result, car ownership and trips are constantly growing on the island, and they are going to create new environmental and congestion problems (cfr. TRANSPLUS, Malta Case Study Report, forthcoming)
finance PT infrastructures and, in particular, to subsidise the PT network service comes more directly from the subsequent justification of regulation, i.e. the presence of externalities.

**Negative externalities:** Often the reason for regulating externalities (or “spillovers”) is that the price of a product does not reflect the true cost to society of producing that good and excessive consumption accordingly results. Urban congestion is perhaps the more widespread example of negative externalities. The rationale for regulation in this case is to eliminate the waste of resources provoked by excessive use of private vehicles in a given space and time, by compelling the internalisation of spillover costs – e.g. with parking or road pricing charges – on polluter pays principles.

- **Implications for LPT regulation:** Considering the potential load factor of public transport – especially metro, rail, but also tram and bus services – as compared to that of a private car, it is evident that any improvement in public transport share has positive impacts on the urban environment and congestion. However, for the impact to be really positive, the potential load factor must become real, i.e. a real increase of public transport ridership, not only of public transport volumes (vehicle.kms), should be observed. Internalisation of private car external costs, e.g. with the implementation of parking charge schemes in inner city areas served by public transport, has been in the recent past one of the most effective tools to shift new passengers to public transport. An adequate ridership is obviously a pre-condition for profitable service operation and a functioning PT market.

**Positive externalities:** In some cases the reason for regulating externalities is the opposite, whenever an activity has positive external effects, or user economies of scale. This is typically the case of goods and services which present consumption or network externalities (i.e. any additional user of the network enhance the utility of the other users connected to the network).

- **Implications for LPT regulation:** Public transport is characterised by positive external effects, because a more dense network and/or an increased service frequency will enhance the benefits for the users. This is also known as the Mohring effect. Commercial operators will fail to take these benefits into account. The fact that profit maximising operators do not take into account the user benefits may even be more problematic in a network if several operators partly compete for the same passengers. Therefore, there is again a strong argument here for public authority responsibility for the public transport...
system as a whole. One must be careful when considering to allow profit maximising operators affect route network, frequencies and prices. For example, in case net-cost contracts are adopted, much concern must be taken for fixing adequate service levels for passenger groups and areas and for the co-ordination of the overall system.

**Continuity and availability of service:** in some circumstances the market may not provide the socially desired levels of continuity and availability of service. In the case of some products or services – for example postal or water services – it may be considered, as a matter of social policy, that these should be generally available at least to a certain minimum standard (this is the so named USO – Universal Service Obligation concept). In the unregulated market, however, competition may lead to “cream-skimming” – the process in which the producer chooses to supply only to the most profitable customers – and services may be withdrawn from poorer or more geographically disperse groupings of customers. Regulation may be justified in order to produce socially desirable results even though the cross-subsidisation effected may be criticizable as inefficient and unfair.

**Implications for LPT regulation:** the extension of the USO concept to public transport is more controversial than for other services, where the need for continuity and availability of the service is more evident (as for electricity, postal services, water). Indeed, public transport is provided in urban areas where population density is enough to sustain the demand for a public transport service, while rural zones are at most – but not always – covered by extra-urban services, whose frequency is not comparable with that of typical urban services. However, car dependency in rural areas can create problems of social exclusion for some categories of people who cannot use the car – elderly, young, low income households etc. Therefore, a minimum public transport service in rural or less dense peri-urban areas can be considered a socially desirable result, and subsidies or special services (e.g. more flexible and less costly demand response services) can be required on these grounds.

**Rationalisation and coordination:** in many situations it is extremely expensive for individuals to negotiate private contracts so as to organise behaviour or industries in an efficient manner – the transaction costs would be excessive. The firms in an industry may be too small and geographically dispersed to bring themselves together to produce efficiently. Enterprises may, moreover, have developed different and incompatibles modes of production. In these circumstances regulation may be justified as a means of rationalising production processes.
Organisational forms

Public ownership

Private concessions

Regulated authorisations

Open entry

Authority initiative

‘Concessions’

Market initiative

‘Authorisations’

Management contract

Own management

(Dominated by private companies)

(Dominated by public companies)

MARETOPE Handbook 93

(perhaps standardising equipment in order to create effective networks) and in order to coordinate the market. It is noteworthy that this rationale for regulation is based more on the desire to enable effective action to take place than on the need to prohibit undesirable behaviour.

Implications for LPT regulation: in the transport sector coordination and regulation by a central agency may be needed in order to organise a route network. Indeed, appropriate network configuration is an important precondition for enabling profitable transport markets. Therefore, the currently poor state of competition and market operation observed in many MARETOPE case studies, and especially in large cities, can be interpreted as a consequence of bad practices in network configuration. To explain this point, a parallel can be done with the airline industry, where deregulation, especially in the US, has been successful. Transport industries, and the airline industry in particular, exhibit different types of networks and are characterised by having producers whose production technologies exhibit economies of networks. These transport networks are composed of a large number of routes and alternative routes in which passenger can be transported from origins to destinations. Perhaps the most visible outcome of the recent deregulation of the US airline industry is the increased use of the Hub-and-Spoke (HS) network. That is, the increase in the competition among airline firms has caused airline firms to decrease the relative number of non-stop direct flights and to re-route passengers via a third city which we call a hub (since 1978, the hub-and-spoke routing has increased by about 50 percent in the US). Actually, a unique feature of airline firms is that in addition to the use of airfare as a strategic variable, they also use network structuring as a strategic variable. There is a basic economic reason for this. The airline industry technology exhibits economies of network: if the fixed cost of maintaining a route in a network is large relative to the number of passengers on that route, then the hub-and-spoke network is the cost-saving network, and it will emerge as a result of deregulation and competition; on the contrary, if the fixed cost of operating a route is small, then the Fully Connected (FC) network, where all origins and destinations are connected with direct flights, becomes the cost-saving network of operation. Transferring this concept to land transport, we should expect that whenever the fixed cost associated with maintaining a route is large relative to the number of passengers, deregulation and cost reducing competition should cause an hub-and-spoke structure of the network to emerge. Public transport – including metro, rail, tram and bus modes – show fixed costs higher than intermediate forms of collective transport – e.g. minibus, taxis – or private car use.
Therefore, efficient network configurations should allow PT to operate on high volume connections, with the creation of a structure of hubs and feeder lines, and leave the low volume connections for the operation of intermediate form of transport, e.g. demand responsive services with lower fixed costs. Often it is not easy to identify efficient sub-networks in the complex web of routes which constitute the whole PT network of a large city, but tendering of efficient sub-networks, including in the extreme cases the entire network or single lines, is fundamental to avoid the practice of tenders for loss-making lines. Incidentally, in the large cities with extended metro lines, this point claims for a full integration of metro and bus services networks, where the metro stops could act as hubs for local bus sub-networks.

5.4.2. Development of tools to enhance the urban transport regulation

The previous chapter has illustrated why a broader perspective should be taken for regulating LPT in a wider context of urban transport regulation, including issues as:

- financing of fixed costs, investment and regulation of access to infrastructures which are still natural monopolies – i.e. metro, rail and road networks – and are basic inputs for transport service operation;
- internalisation of private car external costs and use of revenues from transport pricing to strengthen PT position, against the current “competitive advantage” of automobiles, and arrest the decline of PT market shares;
- minimum transport service requirements for less populated areas or people with reduced mobility
- adequate network configuration to enable efficient transport operations and markets

The above are deemed to be pre-requisites which should be common to any reform process, for enabling an effective creation of competitive LPT markets.

Therefore, in this chapter we will conclude with some consideration about how the development of a basic tool could facilitate the adoption of a broader urban transport regulation perspective.

The basic tool is the so named **open co-ordination method**, which is recommended to achieve an enhanced institutional and financial co-ordination among the various actors whose actions/decisions influence the performance of the LPT system, and of urban transport at
large. This principle of action has been introduced in the new EU Social Policy Agenda [Lisbon European Council - Com(2000) 379 final, Brussels 28.6.2000], and more recently prescribed by the White Paper on European Governance. The guiding principle of the new Social Policy Agenda is to strengthen the role of social policy as a “productive” factor. From the procedural point of view, the fundamental innovation is that the open method of co-ordination, hitherto confined to the employment area, has now to be expanded to other social policies. This means providing a clear and active role to all stakeholders and actors enabling them to participate in managing the policies associated with this new Agenda. All actors, the European Union institutions, the Member States, the regional and local levels, the social partners, civil society and companies have an important role to play.

Consensus building A process which can be considered as ancillary to achieve mutual understanding and co-ordination among several stakeholders positions is consensus building. This aims to identify areas of mutual gain, and attempts to construct “win-win” outcomes from the decision-making process.

However, this process usually takes place in a political and economic context which has been structured by significant inequalities in power between individuals, social groups and organisations. The assumption that underpins this coming-together of unequal and conflicting parties is that there is one “superior objective” which everyone should be able to agree on, e.g. achieving urban sustainable transport.

Another implicit assumption of consensus building is that the opinion formation process can be shaped in several steps of convergence, according to the Merging Opinion Theorem. Briefly, this theorem follows a Bayesian logic, stating that every person is continuously under an Opinion Transformation Process (OTP). Starting from an \(a\ priori\) opinion, he receives new information-knowledge from the environment and uses own Principles & Logic to revise his opinion. In a group opinion transformation process, if the Principles, the Logic and the Input Information are the same, then the opinions converge. In this frame, the consensus building is acknowledged as a complex process, where long term inputs to change Principles and Logic of participants need to be combined with timely Input Information to support decision taken on a short term.

Therefore, given the presence of an overall perspective and strategy moving towards a common goal in a given regional or local context, consensus building can be more concretely described (Acland 1993) as a process which involves getting people together to talk about an area of mutual concern, in order to identify the decisions that should be taken (or avoided).

This process implies five ideal stages:

- **Assessment and preparation**: the existing processes, the issues and the people and parties to be involved in the process should be considered, and these should be built into the participation strategy.
- **Initiation**: how to launch and fund the process is important, as is the venue for negotiation and the timing. Ground rules for the process and how participants will relate to their constituents should also be considered.
- **Negotiation, exploration and exchange**: there is the need for neutral facilitators and mediators. Shared goals should be developed. The means of generating and evaluating options must be considered.
- **Decision-making**: once options have been thoroughly explored it is necessary for commitments to be made. The chosen options must be agreed in some way, determining who pays and implement them.
- **Maintenance**: once people are committed, the process must continue to function until at least some of the proposed solutions are known to be working. Use of tools for evaluation and monitoring should be considered here.

The essence of the consensus-building process is that a negotiated agreement is not an end in itself. The process is just as important as the agreement it produces, especially if the agreement is to achieve the objectives of the participants, gain the commitment of implementers and provide for constructive relationships and future negotiation.

An important remark to be made is that such complex decision-making procedures call for a new culture of evaluation that places more emphasis on deliberation (TRANSTALK, Final Report). At the minimum level this involves making conceptual and methodological choices transparent to allow reflective discussion. At the maximum level, the evaluation should be thought of as simulating a decision process and use methods for gathering different opinions and bringing different actors to discuss issues of common concern, as depicted above with the ideal five stages.

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However, involving stakeholders in the evaluation process does not mean manipulating the results in such a way to benefit one or the other stakeholder, nor is it a means to achieve a win-win solution for all involved. This is indeed hardly possible in situations where there are conflicting interests. Involving stakeholders in the evaluation process rather means, as a minimum, create a common framework for understanding, reflection and trusted communication, and as a maximum, finding a solution which maximises the benefits for most whilst minimising the losses for the few (and eventually to agree upon compensation strategies for the latter, to overcome residual barriers).

A special attention should be given to the deep cultural changes which are often needed to enable consensus building to proceed, and to avoid that the process of change ultimately fails. In fact, sometime there is the need to modify the underlying Principles & Logic governing the opinions and beliefs of some actors, and their willingness to participate in the consensus building process – in other terms to remove cultural barriers to the change process. Examples of situations where more deep cultural barriers should be addressed are illustrated below:

- a successful reform should avoid that concerned employees and staff shape and consolidate an isolation mentality and a too strong autonomy in opposition with management. This is because when problems occur and management is unresponsive, workers could develop a strong corporate mentality with own rules and management would not be aware of incoming performance deficiencies. On the contrary, management should establish a hands-on presence by visiting the team and integrate employees with other parts of the organisation. This allows to detect early warnings and to give employees a sense that they are important and are listened to;

- attention should be paid to quality of the work and not exclusively to the quantity; this will allow to strike a better balance between work and home lives of staff according to their different expectations;

- sometimes resistance to change is far more complex than supposed and it does not necessarily reflect opposition nor is it merely a result of inertia. In some case it is the consequence of contrasting and competing personal commitments: underlying assumptions driving these commitments needs to be identified, discovered and changed if objectives of reform have to be accomplished;

- finally, it is very important to develop a strong sense of participation and involvement of all the agents invested by the change, establishing dialogue, organising meetings and discussions and contributing to create a core of values and behaviour on which all agents
can identify themselves.

As it was illustrated in the previous chapters, the MARETOPE case studies show a scarce presence of cultural tools (3%) compared with consistency of cultural barriers to overcome (20%). If we add cultural, legal and regulatory barriers we reach 56% of all barriers, which show a deficiency with the correspondent tools (35%). Therefore, cultural tools to improve transparency and awareness of the change process appears to be by far the most neglected instruments, but for the same reason this is also the area where future efforts to support regulatory reforms should be concentrated.

A programme of tools development could claim for a more systematic use of techniques for decision analysis, and especially of those which can support decision taking processes involving groups of individuals, as specific cultural tools to assist in the process of change. However, one of the major conclusions of research work on descriptions of group decision making is that of well documented shortcomings (Goodwin and Wright, 1998). The presence of powerful individuals can inhibit the contribution of those who are lower down in the hierarchy. Talkative and extroverted members may dominate the discussions. Janis (1982) has documented a phenomenon that he has termed “group-think” within group decision processes. Group think is essentially the suppression of ideas that are critical of the “direction” in which a group is moving. It is reflected in a tendency to concur with the position or views that are perceived to be favoured by the group. Of course, such forces may produce speedy judgements and commitment to action. However, such cohesive groups may develop rationalisations for the invulnerability of the group's decision and inhibit the expression of critical ideas. These pitfalls of group think are likely to result in an incomplete survey of alternative courses of action or choices. It is fairly evident that when this happens, consensus building processes can produce harmful effects, reducing instead of enhancing the effectiveness of decision making processes.

Awareness of the factors that can degrade group decision making, combined with the implicit belief that group judgement can potentially enhance decision making, has led to a number of structured methods to enhance group decision making by removing or restricting interpersonal interaction and controlling information flow. Perhaps the most famous method of this kind is Delphi, which essentially consists of an iterative process for making quantitative judgements.

However, experimental tests of these techniques as ways of improving judgmental accuracy
have produced mixed results. They improve performance over the simple average of the individual judgements only slightly and seldom do as well as the best member of the group. It has been argued (Ferrell, 1990) that the reason for the poor performance of the method is due to the fact that information sharing is small. This is because participants are anonymous and only a simple statistical summary of others’ judgements is fed back. It follows that the technique does not help the individual to construct an alternative theory or scenario with which to produce a revised prediction.

A possible alternative to avoid the drawbacks of standard Delphi techniques is decision conferencing. Essentially, decision conferencing bring together decision analysis, group processes and information technology over an intensive two- or three-day session attended by people who wish to resolve a complex issue or decision. In this context, a small group of people who have an input to a major decision are often seated on the perimeter of a round table and talk through their problem with a decision analyst, who acts to facilitate group interactions and knowledge sharing. In the background another decision analyst uses interactive decision-aiding technology to model individual and group views on such issues as multi-attribute option evaluation or evolutionary game strategy. The outputs of such modelling seldom agree with unaided holistic judgement.

However, one major responsibility of the decision analyst in the context of decision conferencing is to explain the underlying logic of the modelling methods to the decision makers. Only if decision makers can fully appreciate the methods are they likely to accept model-based choices over their own intuitive judgements.

In the context of the process of change analysed by MARETOPE, that is the regulatory reform of LPT systems, a modelling method which can be adopted is a simplified game theory scheme, as that reproduced below:

<table>
<thead>
<tr>
<th>Operator</th>
<th>Authority</th>
<th>Minimum pay off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do nothing</td>
<td>(0,0)</td>
<td>-5</td>
</tr>
<tr>
<td>Privatised</td>
<td>(+10,-5)</td>
<td>(+5,+5)</td>
</tr>
<tr>
<td><strong>Minimum pay off</strong></td>
<td>-5</td>
<td>+5</td>
</tr>
</tbody>
</table>

To understand this scheme a rudimentary knowledge of game theory is needed, but this is not difficult to be popularised. Briefly, game theory (Straffin, 1993) is the logical analysis of situations of conflict and co-operation. More specifically, a game is defined to be any situation
in which:

i) There are at least two players. A player may be an individual, but it may also be a more general entity like a company, a nation, or even a biological species.

ii) Each player has a number of possible strategies, courses of action which he or she may choose to follow.

iii) The strategies chosen by each player determine the outcome of the game.

iv) Associated to each possible outcome of the game is a collection of numerical payoffs, one to each player. These payoffs represent the value of the outcome to the different players.

Game theory is the study of how players should rationally play games. According to this theory, each player would like the game to end with an outcome which gives him as large a payoff as possible. He has some control over the outcome, since his choice of strategy will influence it. However, the outcome is not determined by his choice alone, but also depends upon the choices of all the other players, and this is where the conflict and co-operation enter. There may be conflict because different players will, in general, values outcomes differently. On the other hand, there is a chance for co-operation because several players together may be able to co-ordinate their strategies to obtain an outcome with better payoffs for all of them.

Game theory is so named, of course, because it abstracts from and generalises the study of traditional games (like chess, bridge and poker). The abstraction and generalisation is powerful enough to include a wide variety of important social situations. For instance, companies pursuing corporate strategies are playing a game. So are political candidates trying to win an election, nations manoeuvring in the international arena etc.

In the stylised game presented in the table above, the players are a Public Authority and a Transport Operator at the initial stage of the LPT reform process. This is represented as a decision to be taken by the transport operator side of do nothing, i.e. maintaining a public monopoly of the service, or privatising, and by the authority side again of do nothing or follow two alternative paths of reform, full deregulation within the market or competitive tendering of the market. The pay-offs (A,B) presented in the table are respectively the change of producer surplus (A) and the welfare change (B). We remind that the figures presented in the table are not producer surplus and welfare change computed for a real case, but purely hypothetical numbers to exemplify possible outcomes of the game.
The game would lead to deregulation and privatisation, which is in this example the welfare maximising result. Note that this simple example assumes, somewhat unrealistically, that the operator is responsible for changes in ownership (capital market competition) and, more realistically, the authority is responsible for changes in regulation concerning product market competition.

Notwithstanding the use of possibly too simplistic assumptions, game theory models as that exemplified above can help to clarify the basic issues at stake among the players of the change process, at least in rational terms. However, the main limitation of any game theory exercise is that it deals with play which is rational, i.e. a game where opponents behave rationally. It is well known that, in the real world, it is quite doubtful that all players will play rationally. But also in this respect, the extent to which players do or do not behave rationally in situation of conflict or co-operation is an interesting question in itself, and one on which game theory can help to make a diagnosis.
6. **Bibliographic References**


➢ Performance analysis

Organisational forms

- Public ownership
- Private concessions
- Regulated authorisations
- Open entry

Authority initiative
'Concessions'

Market initiative
'Authorisations'

Management contract

- Own management (Dominated by public companies)
- Private management (Dominated by private companies)

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- Public ownership
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- Regulated authorisations
- Open entry

Authority initiative
- 'Concessions'

Market initiative
- 'Authorisations'

Management
- Contract
- Own (Dominated by private companies)
- (Dominated by public companies)

References:
Barriers and Tools

- Van de Velde D. / Leijenaar R., Towards innovations in public transport tendering in the Netherlands, March 2002
ANNEX 1 – GUIDELINES FOR IMPACT ASSESSMENT FOR REGULATORY REFORM

Methodological considerations

Below, a series of key performance indicators with respect to urban public transport systems are outlined.

The basis for selecting the set of performance indicators should be that the various aspects of local public transport performance are taken into account. Figure 1 highlights the main performance dimensions: productive efficiency, network design, commercial performance and overall value to society.

Two contexts should be distinguished: (1) key performance indicators utilising the current data in the MARETOPE database; (2) key performance indicators with ideal data.

The indicators utilising the current data will be used to determine the impacts at city level of evolutionary paths. It should be noted that data required for these indicators may not be available for all cities.

Key performance indicators with ideal data will be used to describe how cities should ideally collect data for the diagnostic assessment.

All productivity/cost/efficiency indicators can be calculated at a modal level (as well as LPTS level). The service supply indicators passenger should be determined at the LPTS level although modal information could be included. Market effectiveness and economic welfare should be considered at the LPTS level.
It is assumed that the impact assessment guidance will mostly be used in the context of examination of performance over time for a given city, i.e. time series analysis.

**Key Performance Indicators (KPIs) with Current Data**

<table>
<thead>
<tr>
<th>Category</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity, cost, efficiency</td>
<td>Seat kilometres pr staff hour</td>
</tr>
<tr>
<td></td>
<td>Seat kilometres per vehicle hour</td>
</tr>
<tr>
<td></td>
<td>Total operating cost per vehicle.km</td>
</tr>
<tr>
<td>Service supply (availability)</td>
<td>Network.km per km²</td>
</tr>
<tr>
<td></td>
<td>Seat kilometres per capita</td>
</tr>
<tr>
<td></td>
<td>Seat kilometres per passenger</td>
</tr>
<tr>
<td></td>
<td>Seat kilometres per km²</td>
</tr>
<tr>
<td>Market effectiveness</td>
<td>Passenger.km per capita</td>
</tr>
<tr>
<td></td>
<td>Revenue per passenger.km</td>
</tr>
<tr>
<td></td>
<td>Revenue per vehicle.km</td>
</tr>
<tr>
<td>Economic welfare</td>
<td>Total system costs per passenger</td>
</tr>
<tr>
<td></td>
<td>Consumers’ surplus per passenger</td>
</tr>
<tr>
<td></td>
<td>Producers’ surplus per passenger</td>
</tr>
</tbody>
</table>
Key Performance Indicators (KPIs) with Ideal Data

<table>
<thead>
<tr>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity, cost, efficiency</td>
</tr>
<tr>
<td>Technical efficiency score</td>
</tr>
<tr>
<td>Cost efficiency score</td>
</tr>
<tr>
<td>Service supply (availability)</td>
</tr>
<tr>
<td>Zonal based accessibility indicator (aggregated to city level)</td>
</tr>
<tr>
<td>Zonal based supply indicator (aggregated to city level)</td>
</tr>
<tr>
<td>Market effectiveness</td>
</tr>
<tr>
<td>Public transport market share</td>
</tr>
<tr>
<td>Customer satisfaction</td>
</tr>
<tr>
<td>Revenue per passenger.km</td>
</tr>
<tr>
<td>Revenue per vehicle.km</td>
</tr>
<tr>
<td>Economic welfare</td>
</tr>
<tr>
<td>Detailed cost-benefit appraisal with inclusion of user benefits (incl. time), producer benefits and externalities</td>
</tr>
</tbody>
</table>

General data collection issues

A number of data collection issues will be generic in the sense that they are of relevance to most if not all key performance indicators. These issues will be discussed in the following section.

Consistency

Ideally, data should be consistent across time and space.

- **Longitudinal consistency is of paramount importance.** A highest possible level of reliability should be achieved, i.e. that data definitions should not fluctuate from one year to the next. E.g., if airport buses are included in the number of vehicle kilometres for one year, this should be the case for all other years. If such requirements are not fulfilled, data will have no value. We cannot know whether a leap in an indicator (e.g. costs per vehicle kilometre) is due to a definitional change or a de facto change.
• **Geographical consistency** is in effect a sub-class of longitudinal consistency. The geographical area applied should be defined. What is covered, e.g. the area within council boundaries, or suburban areas of neighbouring municipalities? Do the operators and authorities in question cover the entire area, or a larger area? Are other operators and authorities present in the area, but not part of the analysis? These factors should be stable throughout the period examined. If this is impossible, it should in any case be stated clearly, and if possible, data should be adjusted in order to maintain consistent time series.

• **Category consistency**: By this we mean that different variables should be comparable. If ‘revenues’ cover A (i.e. all regular bus services) but not B (the airport express bus), similarly, ‘costs’ and ‘subsidies’ should also cover A, but not B.

**Estimates and missing data**

Problems of data quality should not be underestimated. There are at least two reasons for making estimates:

• Missing data. If there is sufficient reason to believe that an underlying trend exists, interpolation or estimation based on other time series may be applied. E.g. a missing data point for passenger kilometres may be estimated by using the percentage change in the number of passengers compared to the previous year.

• Changed definitions: Some definitional changes may occur in the data series provided by respondents or in reports, such as inclusion of VAT, average travel length. In order to produce a consistent time series, correction factors may be applied.

In general, good estimates are of greater value than bad data!

**Quality checks**

There should be extensive quality control of data. A key element in a quality assurance process would be to specify detailed definitions and descriptions of the various items and their components.

**Use of indices**

Data analysis and presentation may be facilitated through the usage of indices. Assessment of changes in a given variable is easier. This would also partly address any issues of confidentiality.
Data collection at different levels: company, modal or LPTS

Ideally, data should be split between different modes. This may not always be feasible, especially not with regard to items such as costs and subsidies, as overheads are difficult to define and may be arbitrarily allocated among the modes, or not allocated at all. Great care should be shown here, and all assumptions and conditions should be clearly stated.

Subsequently, modal based information could be aggregated to LPTS where appropriate. Alternatively data may be available at LPTS level only.

In some cases the starting point for data collection may also be collected at company level, where it would be necessary to aggregate data in order to obtain modal and LPTS totals. Great care should again be shown at this stage, and all assumptions and conditions should be clearly stated.
Indicator Catalogue

Key Performance Indicators (KPIs) current data

<table>
<thead>
<tr>
<th>Indicator 1. SEAT KILOMETRES PER STAFF HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brief presentation</strong></td>
</tr>
<tr>
<td>This is a labour productivity indicator showing the average level of seat kilometres per staff hour. Alternative labour productivity indicators could be based on other output or labour input measures. This would include vehicle kilometres as output measure and staff numbers as labour input measure.</td>
</tr>
<tr>
<td><strong>Calculation principles</strong></td>
</tr>
<tr>
<td>The indicator for labour productivity (KPI1) can be calculated as follows:</td>
</tr>
<tr>
<td>[ KPI1 = \frac{SKM}{SH} ]</td>
</tr>
<tr>
<td>where SKM is seat kilometres and SH is staff hours. The labour productivity indicator can be calculated at LPTS level with aggregated information about seat kilometres and staff hours for all modes available in the city (or for those modes where data are available) as well as for individual modes or companies.</td>
</tr>
<tr>
<td><strong>Interpretation issues</strong></td>
</tr>
<tr>
<td>The following issues are of relevance with respect to the labour productivity indicator:</td>
</tr>
<tr>
<td><strong>Single input, single output</strong></td>
</tr>
<tr>
<td>A standard problem with labour productivity ratios (and other partial productivity measures) is the limitations on number of inputs and outputs considered. The use of single input-single output analysis does not allow for a comprehensive description of the productive activities being performed by public transport operators. Therefore, the results should be seen as indicative rather than definitive.</td>
</tr>
<tr>
<td><strong>Dependency of level and quality of other inputs and existence of other relevant outputs</strong></td>
</tr>
</tbody>
</table>
| It follows from the first point that the values of labour productivity recorded will be dependent on the level and quality of other inputs and existence of other relevant outputs. For example, if two bus companies have the same number of staff hours with one of the companies producing a higher number of vehicle kilometres this may be the result of a higher number of vehicles. Therefore, the labour productivity indicator does not show the
productivity of labour in isolation but in the context of what other inputs and outputs are present.

**Vehicle kilometres vs. seat kilometres**
A labour productivity indicator based on vehicle kilometres will not take into account differences in seat capacity over time or between places. These differences can be taken into account using **seat kilometres** as the output measure. This would be relevant in case of substantial variation in seat capacity.

**Lack of quality of output considerations**
The output measure used (seat kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving a high labour productivity may be delivering a poor service. Therefore, other indicators are required to address these issues.

**Aggregated productivity measures**
There may be a problem of interpreting productivity measures for the LPTS as a whole comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus labour productivity and rail labour productivity.

### Data Collection
The calculation of the labour productivity indicator requires information about:

- **Seat kilometres**
  This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, seat kilometres will only be reported as route data, excluding positioning kilometres. Some companies or authorities will only have data for place kilometres (i.e. capacity including the maximum number standing passengers).

- **Staff hours**
  This figure should ideally be divided into staff from **authorities** and **operators** respectively. Furthermore, if possible, the number of driver hours should be specified, in order to produce productivity indicators.

If aggregation is needed to calculate the productivity indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both input and output measures are available for the included sub-components. This means that a company with information
only on inputs or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

**Data Problems**

A number of problems can occur concerning the collection of information for both seat kilometres and staff hours:

- **Seat kilometres**
  
  The most common problem is that no information about seat kilometres is available, only vehicle kilometres. Vehicle kilometres can be used as an alternative output measure provided it can be justified that no significant changes or differences in seat capacity is present. There is likely also to be a problem in getting information about “empty” kilometres.

- **Staff hours**
  
  In general, only information about staff numbers is available. Staff numbers can be used as an alternative provided changes in hours per staff is accounted for. This can be partially undertaken through usage of full-time equivalents. Other problems may relate to the difficulties in splitting staff levels on different modes for companies providing more than a one public transport mode. This would for example be the situation in cities where an integrated public transport operator is responsible for bus, metro, tram services. This is also a problem for staff from public transport authorities.

---

### Indicator 2. SEAT KILOMETRES PER VEHICLE HOUR

**Brief presentation**

This is a vehicle productivity indicator showing the average level of seat kilometres per vehicle hour.

Alternative vehicle productivity indicators could be based on other output or vehicle input measures. This would include vehicle kilometres as output measure and vehicles as input measure.

**Calculation principles**

The indicator for vehicle productivity (KPI2) can be calculated as follows:

\[
KPI2 = \frac{SKM}{VH}
\]
where SKM is seat kilometres and VH is vehicle hours. The vehicle productivity indicator can be calculated at LPTS level with aggregated information about seat kilometres and vehicle hours for all modes available in the city (or for those modes where data are available) as well as for individual modes or companies.

<table>
<thead>
<tr>
<th>Interpretation issues</th>
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<td>The following issues are of relevance with respect to the vehicle productivity indicator:</td>
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</tr>
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<td>A standard problem with vehicle productivity ratios (and other partial productivity measures) is the limitations on number of inputs and outputs considered. The use of single input-single output analysis does not allow for a comprehensive description of the productive activities being performed by public transport operators. Therefore, the results should be seen as indicative rather than definitive.</td>
</tr>
<tr>
<td><strong>Dependency of level and quality of other inputs and existence of other relevant outputs</strong></td>
</tr>
<tr>
<td>It follows from the first point that the values of vehicle productivity recorded will be dependent on the level and quality of other inputs and existence of other relevant outputs. For example, if two bus companies have the same level of vehicle hours with one of companies producing a higher number of seat kilometres this may be the result of higher staff numbers. Therefore, the vehicle productivity indicator does not show the productivity of vehicles in isolation but in the context of what other inputs and outputs are present.</td>
</tr>
<tr>
<td><strong>Vehicle kilometres vs. seat kilometres</strong></td>
</tr>
<tr>
<td>A vehicle productivity indicator based on vehicle kilometres will not take into account differences in seat capacity over time or between places. These differences can be taken into account using seat kilometres as the output measure. This would be relevant in case of substantial variation in seat capacity.</td>
</tr>
<tr>
<td><strong>Lack of quality of output considerations</strong></td>
</tr>
<tr>
<td>The output measure used (seat kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving high vehicle productivity may be delivering a poor service. Therefore, other indicators are required to address these issues.</td>
</tr>
<tr>
<td><strong>Aggregated productivity measures</strong></td>
</tr>
<tr>
<td>There may be a problem of interpreting productivity measures for the LPTS as a whole</td>
</tr>
</tbody>
</table>
comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus vehicle productivity and rail vehicle productivity.

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>The calculation of the proposed vehicle productivity indicator requires information about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Seat kilometres</td>
</tr>
<tr>
<td></td>
<td>This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.</td>
</tr>
<tr>
<td></td>
<td>- Vehicle hours</td>
</tr>
<tr>
<td></td>
<td>This figure should include route as well as positioning ('empty vehicle') production, but this split does not have to be specified. If possible, data should be specified by peak hours and subcontracted hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Problems</th>
<th>A number of problems can occur concerning the collection of information for both seat kilometres and vehicle hours:</th>
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<tr>
<td></td>
<td>- Seat kilometres</td>
</tr>
<tr>
<td></td>
<td>The most common problem is that no information about seat kilometres is available, only vehicle kilometres. Vehicle kilometres can be used as an alternative output measure provided it can be justified that no significant changes or differences in seat capacity is present. There is likely also to be a problem in getting information about “empty” kilometres.</td>
</tr>
<tr>
<td></td>
<td>- Vehicle hours</td>
</tr>
<tr>
<td></td>
<td>In general, only information about number of vehicles is available. Number of vehicles can be used as an alternative, provided change in vehicle hours per vehicle is accounted for. Other problems may relate to the difficulties in aggregating vehicles between modes in the situation where a total measure for vehicle hours is required. Furthermore, problems may include ensuring that all vehicle hours are accounted for, especially with respect to subcontracted hours.</td>
</tr>
</tbody>
</table>
### Indicator 3. OPERATING COST PER VEHICLE KILOMETRE

| Brief presentation | This is a cost performance indicator expressing on average the operating cost incurred per vehicle kilometre. It may be of relevance to calculate the indicator on sub-categories rather than total operating cost only, i.e. labour cost per vehicle kilometre, fuel cost per vehicle kilometre, depreciation cost per vehicle kilometre. |

| Calculation principles | An indicator for cost performance (KPI3) can be specified as follows:  

\[
KPI3 = \frac{C}{VKM}
\]  

where \(C\) is operating costs and \(VKM\) is vehicle kilometre. This indicator can be calculated for individual companies or modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at company or modal level or LPTS data. The indicator can also be calculated for sub-categories of total operating costs, e.g. labour cost per vehicle kilometres, fuel cost per vehicles etc. |

| Interpretation Issues | The following issues are of relevance with respect to the cost performance indicator: |

- **Single output orientation**  
  KPI3 has an implicit assumption that all operating costs can be attributed to the production of a single output (vehicle kilometres). In practice, several outputs are likely to be involved in public transport service provision.  

- **Cost comparability**  
  Changes in cost accounting procedures for a given city may require cost assessments comparisons to be undertaken with caution. Any results should be seen more as indicative information than definitive.  

- **Lack of quality of output considerations**  
  The output measure used (vehicle kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving a low average cost per vehicle kilometre may have lower service quality than another with a higher average cost per vehicle kilometre. |
vehicle kilometre (good cost performance) may be delivering a poor service. Therefore, other indicators to address these issues are required.

- **Aggregated cost performance measures**

There may be a problem of interpreting cost performance measures for the LPTS as a whole comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus cost performance and rail cost performance.

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>The calculation of the cost performance indicator requires information about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Operating cost</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Costs for authorities.</strong> This figure concerns the LPTS only as a whole and does not relate to the specific modes. It should reflect the costs of administration and planning, but not the financial support granted to operators. Subsidies allocated to operators should therefore not be included in this figure. If possible, labour costs should be specified, although this figure will often be inseparable from the total cost.</td>
</tr>
<tr>
<td></td>
<td><strong>Costs for operators</strong> concern operators only and should be split into the following items: labour costs (=staff costs, wages) fuel/power costs; taxation on inputs, i.e. fuel taxes and other duties that are levied directly on production inputs (general tax on profits etc. should not be included); depreciation; interest; other costs (excluding taxes). Costs related to other business areas than public transport should not be included in 'other costs'.</td>
</tr>
</tbody>
</table>
|                 | **Vehicle kilometres**

This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.

If aggregation is needed to calculate the cost performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both cost and output measures are available for the included sub-components. This means that a company with information only on cost or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).
<table>
<thead>
<tr>
<th>Data Problems</th>
<th>A number of problems can occur concerning the collection of information for the cost performance indicator:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Authority costs</td>
</tr>
<tr>
<td></td>
<td>It may be difficult to separate these costs from general transport planning and administration (i.e. including mobility, urban roads, etc.).</td>
</tr>
<tr>
<td></td>
<td>Splitting operator costs on several modes</td>
</tr>
<tr>
<td></td>
<td>Problems may relate to the difficulties in splitting costs on different modes for companies providing more than a one mode. This would for example be the situation in cities where an integrated public transport operator is responsible for bus, metro, tram services.</td>
</tr>
<tr>
<td></td>
<td>Vehicle kilometres</td>
</tr>
<tr>
<td></td>
<td>There could be a problem in getting information about “empty” kilometres. Otherwise, vehicle kilometres are usually available from the relevant transport authority.</td>
</tr>
</tbody>
</table>
### Indicator 4. NETWORK KILOMETRES PER SQUARE KILOMETRE

<table>
<thead>
<tr>
<th>Brief presentation</th>
<th>This is a public transport network density indicator showing the average network density for the area examined. Alternative indicators could be based on other measures for network size. This would include line kilometres.</th>
</tr>
</thead>
</table>
| Calculation principles | The indicator for network density (KPI4) can be calculated as follows:  
$$KPI4 = \frac{NKM}{AREA}$$  
where NKM is network kilometres and AREA is the size of the geographical area. KPI4 can be calculated at LPTS level with aggregated information about seat kilometres for all modes available in the city (or for those modes where data are available) as well as for individual modes. |
| Interpretation issues | The following issues are of relevance with respect to the network density indicator:  
- **No consideration to network utilisation**  
The network density indicator provides no consideration to network utilisation, i.e. the level of public transport service supply available in the area being examined. Other indicators (e.g. vehicle kilometres per capita) are required to address the dimension. It should be noticed that there could be a relative strong correlation between network utilisation and network density.  
- **Aggregated network density measures**  
There may be a problem of interpreting network density measures for the LPTS as a whole comprising possibly several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus network density and rail network density. |
| Data collection | The calculation of KPI4 indicator requires information about:  
- **Network kilometres (one way)**  
By this we mean the number of kilometres of road and/or track served by public transport. |
One-way traffic systems should be treated by calculating the average of street length in both directions. This variable should not be interpreted as the sum of lines, which may be arbitrary due to line splits, weekend variations etc. Rather, the number of kilometres actually served, whether by one line or several, should be measured. The data should be divided into road (incl. tram lines in road) and track (rail, subway and separate tram lines) where possible and applicable.

- **Area**
  Size of the geographical area measured in square kilometres ($\text{km}^2$). It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.

### Data problems

A number of problems can occur concerning the collection of information for the network density indicator

- **Network kilometres not available**
  The most common problem is that no information about network kilometres is available. Often the number line kilometres are reported instead. The problem with line kilometres is that it is calculated as the sum of lines, which may be arbitrary due to line splits, weekend variations etc.

- **Changes in geographical area**
  If changes concerning the geographical area occur with reference either to the public transport area or the built-up area (ideally the two areas should be comparable) this would invalidate the data making it impossible to calculate the market effectiveness indicator. Appropriate corrections should be taken, e.g. utilising information from the transition period where data may be available for both the old and new geographical area.

- **Compatibility between population area and public transport area**
  The public transport geographical area may be different in size compared to the population area. Ideally, correction factors would be available.
## Indicator 5. SEAT KILOMETRES PER CAPITA

### Brief presentation

This is a service supply indicator showing the average level of seat kilometres available per head of population. This indicator could be used in conjunction with seat kilometres per passenger in order to demonstrate the service supply available per passenger compared to the service supply available per capita.

Alternative service supply indicators could be based on vehicle kilometres instead of seat kilometres.

### Calculation principles

The indicator for service supply (KPI5) can be calculated as follows:

\[
KPI5 = \frac{SKM}{POP}
\]

where SKM is seat kilometres and POP is total population. KPI5 can be calculated at LPTS level with aggregated information about seat kilometres for all modes available in the city (or for those modes where data are available) as well as for individual modes.

### Interpretation issues

The following issues are of relevance with respect to the service supply indicator:

- **Vehicle kilometres vs. seat kilometres**
  A supply indicator based on vehicle kilometres will not take into account differences in seat capacity over time or between places. These differences can be taken into account using seat kilometres as the output measure. This would be relevant in case of substantial variation in seat capacity.

- **Lack of quality of output considerations**
  The service supply measure used (seat kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving a high service supply may be delivering a poor service. Therefore, other indicators to address these issues.

- **Aggregated service supply measures**
  There may be a problem of interpreting service supply measures for the LPTS as a whole comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus service supply and rail service supply. It may be more relevant to limit it to modal specific service supply indicators.
## Data collection

The calculation of this service supply indicator requires information about:

- **Seat kilometres**
  
  This figure should include route kilometres and positioning ("empty vehicle") kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.

- **Population**
  
  Population in the analysed area. It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.

## Data problems

A number of problems can occur concerning the collection of information for both seat kilometres and population:

- **Seat kilometres**
  
  The most common problem is that no information about seat kilometres is available, only vehicle kilometres. Vehicle kilometres can be used as an alternative output measure provided it can be justified that no significant changes or differences in seat capacity is present. There is likely also to be a problem in getting information about “empty” kilometres.

- **Changes in geographical area**
  
  If changes concerning the geographical area occur with reference either to the public transport area or the built-up area (ideally the two areas should be comparable) this would invalidate the data making it impossible to calculate the market effectiveness indicator. Appropriate corrections should be taken, e.g. utilising information from the transition period where data may be available for both the old and new geographic area.

- **Compatibility between population area and public transport area**
  
  The public transport geographical area may be different in size compared to the population area. Ideally, correction factors would be available or can be estimated.
**Indicator 6. SEAT KILOMETRES PER PASSENGER**

**Brief presentation**
This is a service supply indicator showing the average level of seat kilometres available per passenger. This indicator could be used in conjunction with seat kilometres per head of population in order to demonstrate the service supply available per passenger compared to the service supply available per capita.

Alternative similar service supply indicators could be based on vehicle kilometres instead of seat kilometres.

**Calculation principles**
The indicator for service supply (KPI6) can be calculated as follows:

\[
KPI6 = \frac{SKM}{PAX}
\]

where SKM is seat kilometres and PAX is the number of passengers. KPI6 can be calculated at LPTS level with aggregated information about seat kilometres for all modes available in the city (or for those modes where data are available) as well as for individual modes.

**Interpretation issues**
The following issues are of relevance with respect to the service supply indicator:

- **Vehicle kilometres vs. seat kilometres**
  A service supply indicator based on vehicle kilometres will not take into account differences in seat capacity over time or between places. These differences can be taken into account using **seat kilometres** as the output measure. This would be relevant in case of substantial variation in seat capacity.

- **Lack of quality of output considerations**
  The supply measure used (seat kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving a high service supply may be delivering a poor service. Therefore, other indicators are required to address these issues.

- **Aggregated service supply measures**
  There may be a problem of interpreting service supply measures for the LPTS as a whole comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between...
say bus service supply and rail service supply. It may be more relevant to limit it to modal specific service supply indicator.

### Data collection

The calculation of this service supply indicator requires information about:

- **Seat kilometres**
  This figure should include route kilometres and positioning ("empty vehicle") kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.

- **Passengers**
  This should be the number of boarding passengers, i.e. a trip consisting of two separate journeys on two different vehicles are counted as two trips, not one. For some conurbations, only 'full journeys' may though be available.

### Data problems

A number of problems can occur concerning the collection of information for both seat kilometres and passengers:

- **Seat kilometres**
  The most common problem is that no information about seat kilometres is available, only vehicle kilometres. Vehicle kilometres can be used as an alternative output measure provided it can be justified that no significant changes or differences in seat capacity is present. There is likely also to be a problem in getting information about “empty” kilometres.

- **Passengers**
  Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, etc. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.
**Indicator 7. SEAT KILOMETRES PER SQUARE KILOMETRE**

| Brief presentation | This is a service supply indicator showing the average level of seat kilometres available in the area examined. Alternative service supply indicators could be based on vehicle kilometres instead of seat kilometres. |
| Calculation principles | The indicator for service supply (KPI7) can be calculated as follows: 

\[ KPI7 = \frac{SKM}{AREA} \]

where SKM is seat kilometres and AREA is the size of the geographical area. KPI7 can be calculated at LPTS level with aggregated information about seat kilometres for all modes available in the city (or for those modes where data are available) as well as for individual modes. |
| Interpretation issues | The following issues are of relevance with respect to the service supply indicator: 

- **Vehicle kilometres vs. seat kilometres**  
  A supply indicator based on vehicle kilometres will not take into account differences in seat capacity over time or between places. These differences can be taken into account using **seat kilometres** as the output measure. This would be relevant in case of substantial variation in seat capacity. 

- **Lack of quality of output considerations**  
  The service supply measure used (seat kilometres) does not reflect service quality such as comfort, reliability, frequency. In this way, a bus system achieving a high service supply may be delivering a poor service. Therefore, other indicators are required to address these issues. 

- **Aggregated service supply measures**  
  There may be a problem of interpreting service supply measures for the LPTS as a whole comprising several modes using different production technology, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between...
say bus service supply and rail service supply. It may be more relevant to limit it to modal specific service supply indicator.

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<td>This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.</td>
</tr>
<tr>
<td></td>
<td>- <strong>Area</strong></td>
</tr>
<tr>
<td></td>
<td>Size of the analysed area measured in km². It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis.</td>
</tr>
</tbody>
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<tr>
<th>Data problems</th>
<th>A number of problems can occur concerning the collection of information for both seat kilometres and area:</th>
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</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>- <strong>Changes in geographical area</strong></td>
</tr>
<tr>
<td></td>
<td>If changes concerning the geographical area occur with reference either to the public transport area or the built-up area (ideally the two areas should be comparable) this would invalidate the data making it impossible to calculate the market effectiveness indicator. Appropriate corrections should be taken, e.g. utilising information from the transition period where data may be available for both the old and new geographical area.</td>
</tr>
<tr>
<td></td>
<td>- <strong>Compatibility between population area and public transport area</strong></td>
</tr>
<tr>
<td></td>
<td>The public transport geographical area may be different in size compared to the population area. Ideally, correction factors would be available or can be estimated.</td>
</tr>
</tbody>
</table>
### Indicator 8. PASSENGER KILOMETRES PER CAPITA

<table>
<thead>
<tr>
<th>Brief presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a market effectiveness indicator showing the average level of passenger kilometres per head of population. It provides an indication of public transport consumption among the population in the geographical area considered. Alternative market effectiveness indicators could be based on other public transport demand measures, e.g. passenger numbers or full journeys.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculation principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>The market effectiveness indicator (KPI8) can be specified as follows:</td>
</tr>
</tbody>
</table>

\[
KPI8 = \frac{PKM}{POP}
\]

where PKM is passenger kilometres and POP is the population. This indicator can be calculated for individual public transport modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at modal level or LPTS data. It is not relevant to calculate the indicator at company level as the indicator is measuring the actual usage of a given mode compared to the population. It could be of relevance to calculate the indicator for different socio-economic groups, e.g. according to age, gender, occupation and income. |

<table>
<thead>
<tr>
<th>Interpretation issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following issues are of relevance with respect to the market effectiveness indicator:</td>
</tr>
</tbody>
</table>

- **Lack of information about public transport market shares**

  The number of passenger kilometres provides useful information about market effectiveness. However, the chosen indicator does not establish how public transport modes compare to other modes, notably car based transport modes. For example, it is possible to have a situation where public transport passenger kilometres increases but this is outweighed by even stronger increases from other modes.

- **Public transport usage by non-residents**

  A high value of the market effectiveness indicator is not a necessary condition for the resident population to have high public transport usage as the passenger kilometres refer to public transport travel for both resident and non-resident persons (e.g. tourist or day-visitors). Similarly, in case of increases in the market indicator it may not imply increased...
public transport demand by residents

<table>
<thead>
<tr>
<th>Data collection</th>
<th>The calculation of the market effectiveness performance indicator requires information about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Passenger kilometres</td>
</tr>
<tr>
<td></td>
<td>Passenger kilometres are often calculated on the basis of an assumed average travel distance. These assumptions are in some cases somewhat arbitrary and may change over time. Therefore, these data should be carefully assessed. It could be of relevance to collect passenger kilometre data for different socio-economic groups e.g. according to age, gender, occupation and income.</td>
</tr>
<tr>
<td></td>
<td>• Population</td>
</tr>
<tr>
<td></td>
<td>Population in the analysed area. It is important that the geographical definition is constant across time. Otherwise, data would not be compatible over time. For instance, if an operator in city A gains a contract outside city A within the period, all data concerning this contract should be omitted from the analysis. It could be of relevance to collect population data for different socio-economic groups e.g. according to age, gender, occupation and income.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data problems</th>
<th>A number of problems can occur concerning the collection of information for the market effectiveness indicator:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Passenger kilometres not available</td>
</tr>
<tr>
<td></td>
<td>The most common problem is that no information about passenger kilometres is available, only passenger numbers. Passenger numbers can be used as an alternative measure for public transport usage provided it can be justified that no significant changes or differences in average trip length is present.</td>
</tr>
<tr>
<td></td>
<td>• Changes in geographical area</td>
</tr>
<tr>
<td></td>
<td>If changes concerning the geographical area occur with reference either to the public transport area or the built-up area (ideally the two areas should be comparable) this would invalidate the data making it impossible to calculate the market effectiveness indicator. Appropriate corrections should be taken, e.g. utilising information from the transition period where data may be available for both the old and new geographic area.</td>
</tr>
<tr>
<td></td>
<td>• Compatibility between population area and public transport area</td>
</tr>
<tr>
<td></td>
<td>The public transport geographical area may be different in size compared to the population area. Ideally, correction factors would be available.</td>
</tr>
</tbody>
</table>
## Indicator 9. REVENUE PER PASSENGER KILOMETRE

| **Brief presentation** | Market effectiveness performance will in part be reflected in ticket revenue generated. It may seem that this is in contrast to the aim of high level of public transport usage (covered by the previous indicator), since higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc. This ingenuity can and should also extend to other aspects of market segmentation, like provision of other services related to public transport. The indicator provides information about the average revenue generated per unit of public transport usage (in this case passenger kilometres). |
| **Calculation principles** | The market effectiveness indicator (KPI9) can be specified as follows: 

\[
KPI9 = \frac{R}{PKM}
\]

where \( R \) is ticket revenue and \( PKM \) is passenger kilometres. This indicator can be calculated for individual public transport modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at modal level or LPTS data. |
| **Interpretation issues** | The following issues are of relevance with respect to the revenue generating performance indicator:

- **Market effectiveness and revenue generation**
  
  As noted there may be a conflict between good performance in terms of public transport usage and revenue generation because higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc.

- **Revenue generation and system performance**
  
  As such a high level of revenue per passenger kilometre does not alone ensure good performance of the system including high level of public transport usage. Other indicators would be required to provide a comprehensive assessment of performance. |
### Data collection

The calculation of the revenue performance indicator requires information about:

- **Ticket revenue**
  
  This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

- **Passenger kilometres**
  
  Passenger kilometres are often calculated on the basis of an assumed average travel distance. These assumptions are in some cases somewhat arbitrary and may change over time. Therefore, these data should be carefully assessed.

If aggregation is needed to calculate the revenue performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both revenue and output measures are available for the included sub-components. This means that a company with information only on revenue or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

### Data problems

A number of problems can occur concerning the collection of information for the revenue generating indicator:

- **Ticket revenue**
  
  There may be problems in relation to collection of information about ticket revenue, incl.
ensuring that the data do not include any subsidy element. Furthermore, there could be difficulties from accounting changes occurring over time.

- **Passenger kilometres not available**
  The most common problem is that no information about passenger kilometres is available, only passenger numbers. Passenger numbers can be used as an alternative measure for public transport usage provided it can be justified that no significant changes or differences in average trip length is present.
### Indicator 10. REVENUE PER VEHICLE KILOMETRE

**Brief presentation**
Market effectiveness performance will in part be reflected in ticket revenue generated. It may seem that this is in contrast to the aim of high level of public transport usage (covered by KPI8), since higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc. This ingenuity can and should also extend to other aspects of market segmentation, like provision of other services related to public transport.

The indicator provides information about the average revenue generated per unit of public transport supply (in this case vehicle kilometres).

**Calculation principles**
The market effectiveness indicator (KPI10) can be specified as follows:

\[
KPI10 = \frac{R}{VKM}
\]

where \( R \) is ticket revenue and \( VKM \) is vehicle kilometres. This indicator can be calculated for individual public transport modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at modal level or LPTS data.

**Interpretation issues**
The following issues are of relevance with respect to the revenue generating performance indicator:

- **Market effectiveness and revenue generation**
  As noted there may be a conflict between good performance in terms of public transport usage and revenue generation because higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc.

- **Revenue generation and system performance**
  As such a high level of revenue per vehicle kilometre does not alone ensure good performance of the system including high level of public transport usage. Other indicators would be required to provide a comprehensive assessment of performance.
- **Revenue comparability**
  Changes in accounting procedures for a given city may require revenue assessment comparisons to be undertaken with caution. Any results should be seen more as indicative information than definitive.

- **Aggregated performance measures**
  There may be a problem of interpreting revenue per vehicle kilometre measures for the LPTS as a whole comprising several modes, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus revenue generating performance and rail revenue generating performance. For example, differences between rail and bus revenue generation could be the result of different price regulation regimes.

<table>
<thead>
<tr>
<th><strong>Data collection</strong></th>
<th>The calculation of the revenue performance indicator requires information about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ticket revenue</strong></td>
</tr>
<tr>
<td></td>
<td>This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.</td>
</tr>
<tr>
<td></td>
<td><strong>Vehicle kilometres</strong></td>
</tr>
<tr>
<td></td>
<td>This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.</td>
</tr>
</tbody>
</table>

If aggregation is needed to calculate the revenue performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both revenue and output measures are available for the included sub-components. This means that a company with information only on revenue or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

<table>
<thead>
<tr>
<th><strong>Data problems</strong></th>
<th>A number of problems can occur concerning the collection of information for the revenue generating indicator:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ticket revenue</strong></td>
</tr>
<tr>
<td></td>
<td>There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, there could be</td>
</tr>
<tr>
<td>Organisation forms</td>
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<td>------------------------------------------------------</td>
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<tr>
<td>Public ownership</td>
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<td>Private concessions</td>
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<td>Regulated authorisations</td>
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<td>Open entry</td>
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<tr>
<td>Authority initiative</td>
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<td>'Concessions'</td>
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<td>Market initiative</td>
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<tr>
<td>'Authorisations'</td>
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<tr>
<td>Management contract</td>
<td></td>
</tr>
<tr>
<td>Own management (Dominated by private companies)</td>
<td></td>
</tr>
<tr>
<td>(Dominated by public companies)</td>
<td></td>
</tr>
</tbody>
</table>

- **Vehicle kilometres**
  
  There could be a problem in getting included “empty” kilometres. Otherwise, vehicle kilometres are usually available from the relevant transport authority.
# Indicator 11. TOTAL SYSTEM COSTS PER PASSENGER

## Brief presentation

Total system costs consist of three parts: generalised costs of passengers, producer costs and environmental costs. The generalised costs are calculated by summing up the estimated total travel time costs and the financial costs. The analysis of total system costs explores the welfare issue from the perspective of assessment of the costs for public transport users, producers and society as a whole, which is a very good supplement to the welfare analysis based on the benefits derived.

The total system cost is mainly of relevance at the overall LPTS level, although it is possible to undertake the calculation at modal level (in order to provide evidence concerning the modal contribution towards total LPTS system costs).

## Calculation principles

The total system indicator (KPI11) can be specified as follows:

$$KPI11 = \frac{TSC}{PAX} = \frac{TTC + R + (1 + \lambda)(C - R) + EC}{PAX}$$

where TSC is the total system costs and PAX is the number of public transport passengers. The total system costs are composed of the following elements:

- Generalised costs for users, TTC+R, where TTC is the total travel time costs (wait time, ride time and walk time) and R is ticket revenue.
- Producer costs, C-R, where C is costs and R is ticket revenue, $\lambda$ is the shadow cost of public funds.
- Environmental costs, EC. Usually, environmental costs would be calculated on the basis of a unit cost per public transport vehicle kilometre, distinguishing between the different modes (bus, rail, tram etc.). The total cost would then be determined by multiplying the unit cost by the number of vehicle kilometres.

## Interpretation issues

The following issues are of relevance with respect to the total system cost indicator:

One advantage of the total system costs approach is that it is straightforward. By summing up wait time costs, ride time costs, financial costs borne by passengers, one is able to obtain the generalised costs. If the environmental costs were ignored, the total system costs would be the sum of generalised costs and operating costs borne by PT operators.
Under certain assumptions, it is relatively easy to calculate the total system costs.

The main disadvantage of the total system costs approach is that it emphasises cost rather than benefits to consumers and producers and its basic assumption in terms of micro-economic analysis is questionable. When calculating the total time costs the demand curve (with respect to generalised costs) is assumed to be vertical. However, the validity of this assumption is under challenge, as the generalised costs elasticity of public transports is always different from zero. In short, compared to the welfare approach, total system costs approach bypasses the issue of elasticity estimation by assuming a vertical demand curve.

Another disadvantage of the total system cost approach is that journey length may have to be based on educated guess, if such data are not available. There are several possibilities to estimate the journey length, each one has its pros and cons.

**Data collection**

The calculation of the total system cost indicator requires information about a number of variables, incl.:

**Generalised user costs**
Calculation of the generalised user costs requires information about: ticket revenues (to reflect the monetary cost incurred by public transport users) and total travel time costs.

**Ticket revenue**
See below.

**Total travel time costs**
The inclusion of travel time costs in the calculation of total system costs can be based on information on: wait time, ride time and ideally walk time. This information can be established in various ways incl.: outputs from transport models, survey work and simplifying assumptions about relations for variables available determining travel time.

**Producer costs**
The part of total system concerned with producer cost can be determined with data on: operating cost, ticket revenue and information about the shadow cost of public funds.

**Operating cost**:
Costs for authorities. This figure concerns the LPTS only as a whole and does not relate to
the specific modes. It should reflect the costs of administration and planning, but not the financial support granted to operators. Subsidies allocated to operators should therefore not be included in this figure. If possible, labour costs should be specified, although this figure will often be inseparable from the total cost. Costs for operators concern operators only and should be split into the following items: labour costs (=staff costs, wages) fuel/power costs; taxation on inputs, i.e. fuel taxes and other duties that are levied directly on production inputs (general tax on profits etc. should not be included); depreciation; interest; other costs (excluding taxes). Costs related to other business areas than public transport should not be included in ‘other costs’.

Total ticket revenue:
This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

Shadow cost of public funds
The usage of public funds for public transport requires taxes which have a welfare distorting effect on the economy. Usually, it is assumed that the costs of public funds are 20%, i.e. 20% should be added to the net-cost in order to determine the overall resource cost to the economy.

Environmental costs
The environmental cost estimation requires information about unit cost per vehicle kilometre and vehicle kilometre. The environmental unit cost would normally include uncovered costs of accidents, noise and pollution costs, and costs of congestion imposed upon other actors.

Data problems
A number of problems can occur concerning the collection of information for the total system cost indicator:

• Authority costs
It may be difficult to separate these costs from general transport planning and administration (i.e. including mobility, urban roads, etc.).

• Ticket revenue
There may be problems in relation to collection of information about ticket revenue, incl.
ensuring that the data do not include any subsidy element.

- **Travel time costs**
  Collection of information about travel times may be problematic in situations with lack of appropriate transport models and/or comprehensive passenger surveys. As mentioned it is possible to establish some rough estimates on the basis of simplifying assumptions concerning the relationships between variables determining travel times.

- **Passengers**
  Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, et cetera. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.

- **Environmental costs**
  Estimation of environmental costs may involve substantial uncertainties, incl. monetary values of the various quantitative environmental impacts such as noise and local air pollution.
### Indicator 12. CONSUMERS’ SURPLUS PER PASSENGER

| Brief presentation | In the context of public transport, consumers’ surplus is defined as the sum of the amount each public transport user is willing to pay for the transport service minus the costs incurred by the user (in terms of travel time and the fare, i.e. generalised costs). Consumers’ surplus per passenger would measure the benefits obtained from public transport on average per PT user. |
| Calculation principles | The basis for the calculation of consumers’ surplus requires an assumption regarding the functional form of the public transport demand curve. If a linear demand function is assumed, consumers’ surplus for a given LPTS at a given time can be calculated as: |

\[
CS = 0.5 \times Q \times \left( \frac{Q}{b} \right)
\]

Where \( Q \) is public transport demand measured in passenger kilometres (or passenger trips) and \( b = \eta \times \frac{Q}{GC} \) with GC the generalised cost and \( \eta \) the generalised cost elasticity for the city being examined.  

KPI12, consumers’ surplus per passenger, can then be expressed as

\[
KPI12 = \frac{CS}{PAX}
\]

The calculation of consumers’ surplus can be undertaken at LPTS or modal level. However, if information about the magnitude of consumers’ surplus is required for the public transport system as a whole, it is necessary to apply a LPTS level. Ideally, this calculation will be based on modal specific demand functions with specific consumers’ surplus estimates for each mode and subsequently aggregated to form the LPTS total.  

| Interpretation issues | The following issues are of relevance with respect to the consumers’ surplus indicator: |
| | The advantage of this approach is that it estimates the real consumers’ surplus, which is a direct measure of economic welfare. Another advantage of this approach is that it explicitly makes assumption about the shape of the demand curve, which is more realistic than the assumption of a vertical demand curve. |
The major disadvantage of the welfare approach is the estimation of a generalised cost elasticity. Due to the problem of insufficient number of observations for a given city, the price elasticity estimation might not be quite reliable. Moreover, there are many more influencing factors that determine demand than those available for estimation of generalised cost elasticity. Nevertheless, the problem of biased elasticity estimation might not be as important as it appeared, as sensitivity tests prove that the impact of price elasticity on consumers’ surplus, and thus welfare is very small.

Obviously, the obtained consumers’ surplus estimate may have problems due to the possibility for misspecification with respect to the demand function. The problem of misspecification can be minimised by estimating consumers’ surplus with a range of assumptions about the demand function (incl. a linear demand function).

In some cases it is not possible to adopt a generalised cost approach due to difficulties in estimating the travel time component. In the context of a linear demand function estimation of consumers’ surplus based on fares alone would provide a correct estimate provided that the time related costs remain constant over time (and the linear demand function represents an appropriate approximation).

### Data collection

The following information is required in order to estimate the consumers’ surplus indicator:

- **Assumption about public transport demand function**
  There are several possibilities concerning the assumptions for the passenger demand function, e.g. linear and negative exponential. A linear demand function has the advantage that estimation of consumers’ surplus based on fares alone would provide a correct estimate provided that the time related costs remain constant over time.

- **Average generalised cost per unit of demand (e.g. generalised cost per passenger kilometre)**
  Calculation of the generalised user costs requires information about: ticket revenues (to reflect the monetary cost incurred by public transport users) and total travel time costs.

  **Ticket revenue**
  This figure should include all kinds of tickets, incl. season tickets, multi-journey tickets, passes and so forth. It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.
Total travel time costs
The inclusion of travel time costs in the calculation of total system costs can be based on information on: wait time, ride time and ideally walk time. This information can be established in various ways incl.: outputs from transport models, survey work and simplifying assumptions about relations for variables available determining travel time.

- **Generalised cost elasticity**
  Two approaches are available concerning collection of information about generalised cost elasticity: (1) ideally, the estimate for generalised cost elasticity will be derived through estimation of a public transport demand model (this may involve separate models for the public transport modes existing in the city), (2) alternatively, usage of elasticity estimates from other studies, preferably referring to the same city.

- **Passengers**
  Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, etc. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.

**Data problems**
A number of problems can occur concerning the collection of information to estimate consumers’ surplus per passenger:

- **Ticket revenue**
  There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, changes in accounting procedures would make comparability over time difficult.

- **Travel time costs**
  Collection of information about travel times may be problematic in situations with lack of appropriate transport models and/or comprehensive passenger surveys. As mentioned it is possible to establish some rough estimates on the basis of simplifying assumptions concerning the relationships between variables determining travel times.

- **Passengers**
  Often, passenger numbers are somewhat unreliable due to estimation of the amount of
trips per pass holder, et cetera. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.
# Indicator 13. PRODUCERS’ SURPLUS PER VEHICLE KILOMETRE

<table>
<thead>
<tr>
<th>Brief presentation</th>
<th>This indicator expresses the economic surplus generated by the public transport system (or an individual mode) per unit of supply, e.g. vehicle kilometres.</th>
</tr>
</thead>
</table>
| Calculation principles | Producers’ surplus is calculated by subtracting total operating costs \( (C) \) from total ticket revenue \( (R) \) taking into the shadow cost of public funds:  
\[
PS = (1 + \lambda) * (R - C)
\]
where \( R \) is ticket revenue, \( C \) is operating cost and \( \lambda \) is the shadow cost of public funds (expressed in percentage terms). 

Then, the total producers’ surplus is divided by vehicle kilometres \( (VKM) \), which measures the producers’ surplus per unit of output. \( KPI13 \), producers’ surplus per passenger, can then be expressed as:  
\[
KPI13 = \frac{PS}{VKM}
\]
The calculation of producers’ surplus can be undertaken at LPTS or modal level. However, if information about the magnitude of producers’ surplus is required for the public transport system as a whole it is necessary to apply a LPTS level. Ideally, this calculation will be based on modal specific demand functions with specific consumers’ surplus estimates for each mode and subsequently aggregated to form the LPTS total. |
| Interpretation issues | The following issues are of relevance with respect to the cost performance indicator:  
- **Cost and revenue comparability**  
Changes in accounting procedures for a given city may require producer surplus assessments to be undertaken with caution. Any results should be seen more as indicative information than definitive.  
- **Aggregated performance measures**  
There may be a problem of interpreting producers’ surplus for the LPTS as a whole comprising several modes, e.g. bus vs. rail modes. This could be problematic in the context where a new mode appears making comparisons over time difficult. |
| Data collection | Calculation of producers’ surplus per vehicle kilometre requires information about: |

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[1] MARETOPE Handbook 149
Producer costs

The part of total system concerned with producer cost can be determined with data on: operating cost, ticket revenue and information about the shadow cost of public funds.

Operating cost:

Costs for authorities. This figure concerns the LPTS only as a whole and does not relate to the specific modes. It should reflect the costs of administration and planning, but not the financial support granted to operators. Subsidies allocated to operators should therefore not be included in this figure. If possible, labour costs should be specified, although this figure will often be inseparable from the total cost. Costs for operators concern operators only and should be split into the following items: labour costs (=staff costs, wages) fuel/power costs; taxation on inputs, i.e. fuel taxes and other duties that are levied directly on production inputs (general tax on profits etc. should not be included); depreciation; interest; other costs (excluding taxes). Costs related to other business areas than public transport should not be included in 'other costs'.

Total ticket revenue:

This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

Shadow cost of public funds

The usage of public funds for public transport requires taxes which have a welfare distorting effect on the economy. Usually, it is assumed that the costs of public funds are 20%, i.e. 20% should be added to the net-cost in order to determine the overall resource cost to the economy.

Passengers

Often, passenger numbers are somewhat unreliable due to estimation of the amount of trips per pass holder, et cetera. Furthermore, the level of fare evasion in some cities is high, and there may be a large discrepancy between transported passengers and paying passengers. In some cases cities are not reporting number of passengers but only full journeys or passenger kilometres.

Data problems

A number of problems can occur concerning the collection of information for the producers’ surplus indicator:
<table>
<thead>
<tr>
<th>• Authority costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>It may be difficult to separate these costs from general transport planning and administration (i.e. including mobility, urban roads, etc.).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>• Splitting operator costs on several modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems may relate to the difficulties in splitting costs on different modes for companies providing more than a one mode. This would for example be the situation in cities where an integrated public transport operator is responsible for bus, metro, tram services. Furthermore, there could be difficulties from accounting changes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>• Ticket revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, there could be difficulties from accounting changes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>• Vehicle kilometres</th>
</tr>
</thead>
<tbody>
<tr>
<td>There could be a problem in getting information about “empty” kilometres. Otherwise, vehicle kilometres are usually available from the relevant transport authority.</td>
</tr>
</tbody>
</table>
Key Performance Indicators (KPIs) with Ideal Data

A. Productivity, cost and efficiency

Data Envelopment Analysis (DEA) and Free Disposal Hull Analysis (FDH) examine the efficiency of similar production units using so-called dominance comparisons of the units’ inputs and outputs. Each production unit is compared to the whole sample of production units in order to determine whether there exist other production units (or combinations of production units) using the same or less of the inputs to produce the same or more of the outputs. If this is the case, the production unit is declared inefficient. Otherwise, the production unit is efficient. In this way the efficiency concept is a relative one as it is only concerned with efficiency in relation to the sample and not some absolute efficiency standard.

Formally, assume there are \( n \) production units (indexed as \( k=1,\ldots,n \)) using \( m \) inputs (indexed as \( j=1,\ldots,m \)) to produce \( s \) outputs (indexed as \( i=1,\ldots,s \)). The \( k \)th production unit can now be described by the production vector \((X_k, Y_k)\) where \( X_k = (x_{k1}, \ldots, x_{kj}, \ldots, x_{km}) \) is the input vector and \( Y_k = (y_{k1}, \ldots, y_{ki}, \ldots, y_{ks}) \) is the output vector. Consider the dominance comparison for production unit \( k0 \) (where \( k0 \) belongs to the sample of \( n \) production units). DEA compares \( k0 \) to linear combinations of the \( n \) production units, i.e. \((\sum \lambda_k X_k, \sum \lambda_k Y_k)\) with \( \lambda_k \geq 0 \) (\( \lambda = (\lambda_1, \ldots, \lambda_n) \) is an intensity vector that forms convex combinations of observed input vectors and output vectors). Therefore, \( k0 \) is dominated in terms of inputs if \( \sum \lambda_k x_{kj} \leq x_{k0j} \) holds for all inputs with strict inequality for at least one input and \( \sum \lambda_k y_{ki} \geq y_{k0i} \) is satisfied for all outputs for at least one combination of production units. Similarly, if \( \sum \lambda_k x_{kj} \leq x_{k0j} \) for all inputs and \( \sum \lambda_k y_{ki} \geq y_{k0i} \) for all outputs with strict inequality for at least one output for at least one combination of production units, \( k0 \) is dominated in terms of outputs. Dominated production units are inefficient while undominated ones are efficient.

Production technology structure

If \( \lambda_k \geq 0 \) is the only restriction on \( \lambda \) then it is assumed that the underlying production technology satisfies constant returns to scale (CRS). The analysis with a variable returns to scale (VRS) technology can be undertaken by introducing the restriction that \( \sum \lambda_k = 1 \). Similarly, it is possible to construct non-increasing returns to scale (NIRS) and non-decreasing returns to scale (NDRS) technologies by changing the assumption that \( \sum \lambda_k = 1 \) to \( \sum \lambda_k \leq 1 \) (NIRS) or \( \sum \lambda_k \geq 1 \) (NDRS). Free Disposal Hull Analysis (FDH) restricts the dominance comparison for \( k0 \) to be with respect to other observed production units, i.e. FDH excludes linear combinations of production units from the analysis. Keeping the previous notation, FDH compares \((X_{k0}, Y_{k0})\) to \((\sum \lambda_k X_k, \sum \lambda_k Y_k)\) where \( \lambda_k \in (0,1) \) and \( \sum \lambda_k = 1 \). The definition of dominance is as before, but the added restrictions on \( \lambda_k \) imply that it is less likely for a production unit to be dominated, i.e. inefficient.
Efficiency measures

Thus, DEA and FDH can be used to classify a set of production units into two subsets: (a) efficient production units and (b) inefficient production units. Additional information about the inefficient production units’ deviation from efficiency can also be derived using DEA or FDH through the calculation of efficiency measures for each production unit. The efficiency measure quantifies the distance from the observation to the best-practice technology; i.e. it projects an inefficient unit onto the frontier.

A range of different types of efficiency measures can be calculated within the DEA model, where two key distinctions can be drawn:

- Orientation of the efficiency measure: input orientation, output orientation, or base-orientation
- Radial or non-radial efficiency measures

Orientation

Input oriented efficiency measure compares the actual input level for a given production unit to the best practice input level (defined as the combination of production units that dominate the most), holding the outputs constant, i.e. it quantifies the input reduction required for the production unit to become efficient. Similarly, an output oriented efficiency measure relates the actual output level of a production unit to the potential (best-practice) output level, holding the inputs constant, i.e. the efficiency measure quantifies the required output expansion to become efficient. Base-oriented quantifies necessary improvements for both inputs and outputs in order for a production unit to become efficient. The choice of orientation would depend on the extent to which inputs, outputs or both are controllable. In the context of the bus industry it appears that input oriented models are definitely valid. The applicability of output or base oriented models would depend on the outputs chosen, e.g. passenger kilometres vs. seat kilometres (the latter output may be controllable by the bus company; this is not the case with passenger kilometres).

Figure 1 illustrates the role of orientations in DEA in the single-input-single output case. In the case of Observation A (an inefficient observation) an input-oriented efficiency measure would concern reductions in the input level used at A along the horizontal arrow holding the output level constant (with efficiency being achieved at X). An output-oriented efficiency measure would involve expansions in output level at A along the vertical arrow holding the input level constant (with efficiency being achieved at Y). Notice that the X and Y may not be observed (efficient) production units, but could be formed through combinations of production units.
Radial or non-radial efficiency measures

Radial efficiency measures (input, output or base orientation) determine the changes required for each observation in inputs and/or outputs to become efficient on the basis of equiproportionality, i.e. that all factors are changed by the same percentage.

For example, a radial input efficiency measure for k0 can be calculated as follows: For each dominating combination of production units, \((\sum \lambda_k X_k, \sum \lambda_k Y_k)\), compute the input ratios \((\sum \lambda_k X_k) / x_{k0j}\). The smallest of these ratios \((\sum \lambda_k X_k) / x_{k0j}\) which satisfies

\[\sum \lambda_k X_k \leq (\sum \lambda_k X_k) / x_{k0j} \cdot x_{k0j}\]

for all inputs, is chosen as the input efficiency measure. The input efficiency measure will take values in the range from zero to one with inefficient production units having values below one. A necessary condition for a production unit to be input efficient is that the input efficiency measure is equal to one. A sufficient condition for input efficiency would require that

\[\sum \lambda_k X_k = (\sum \lambda_k X_k) / x_{k0j} \cdot x_{k0j}\]

holds for all inputs. This problem is caused by the way the efficiency measure is calculated: it measures the proportionate reduction in the inputs necessary for a production unit to undertake in order to become efficient. However, after reducing all inputs proportionately further reductions for some inputs might be possible, i.e. slacks may exist. In a similar way a radial output or base-oriented efficiency measure can be derived for k0, but the details will not be included in this paper, see e.g. Fried et al. (1993).
The problem of slacks associated with radial efficiency measures can be addressed through so-called non-radial efficiency measures. A non-radial efficiency measure can be calculated in different ways, but the most common is the Färe-Lovell measure, see Färe & Lovell (1978). In the following, we will concentrate on the Färe-Lovell measure. The key element in the Färe-Lovell measure is the calculation of specific efficiency measures for each input and/or output. These specific efficiency measures should be determined such that the average required improvement across the inputs and/or outputs is maximised. In the case of the Färe-Lovell measure it is important to notice that a value equal to one is a necessary and sufficient conditions for efficiency as it would imply that each of the input and/or output specific efficiency measures are equal to one.

**Examples of the mathematical programming problems for DEA/FDH efficiency measures**

The calculation of efficiency measures can for both DEA and FDH be formulated as mathematical programming problems, see e.g. Fried et al. (1993) for an overview. For example, the radial input efficiency measure with CRS can be calculated through the LP problem

\[ [1] \quad \text{MIN } \lambda_k, \theta_{k0} \]

\[ \text{s.t.} \]

\[ \sum_k \lambda_k x_{ki} \leq \theta_{k0} x_{k0i} \]

\[ \sum_k \lambda_k y_{ki} \geq y_{k0i} \]

\[ \lambda_k \geq 0 \]

where \( \theta_{k0} \) is the efficiency measure. This measure takes values between 0 and 1.

Similarly, the radial FDH output efficiency measure can be determined in the Integer Programming problem

\[ [2] \quad \text{MIN } \lambda_k, \theta_{k0} \]

\[ \text{s.t.} \]

\[ \sum_k \lambda_k x_{ki} \leq x_{k0i} \]

\[ \sum_k \lambda_k y_{ki} \geq y_{k0i}/\theta_{k0} \]

\[ \lambda_k \geq 0 \]
\[ \sum_{i} \lambda_{i} = 1 \]
\[ \lambda_{i} \in \{0, 1\} \]

**Super-efficiency**

The measure of super-efficiency was put forward by Andersen and Petersen (1993) as a way to distinguish between the efficient observations. In particular, the super-efficiency measure examines the maximal radial change in inputs and/or outputs for an observation to remain efficient, i.e. how much can the inputs be increased (or the outputs decreased) while not become inefficient. The larger the value of the super-efficiency measure the higher an observation is ranked among the efficient units. Super-efficiency measures can be calculated for both inefficient and efficient observations. In the case of inefficient observations the values of the efficiency measure do not change, while efficient observations may obtain higher values. Values of super-efficiency are therefore not restricted to 1 (for the efficient observations), but can in principle take any value greater than or equal 1.

Super-efficiency measures are calculated on the basis of removing the production unit from the best-practice reference technology. This explains why the inefficient observations do not change value by calculating super-efficiency measures, as the inefficient observations are not influencing the best-practice technology.

**Strengths and weaknesses**

A number of advantages of DEA and FDH analysis can be identified. One of the main advantages is that no functional form regarding the relation between inputs and outputs is necessary in order to compute the efficiency measures. Secondly, the techniques allow for multiple inputs and multiple outputs without the use of weighting factors. In this way a more valid model of production activities is provided. This implies that DEA/FDH can be applied in situations where inputs and/or outputs are measured in physical units creating the possibility for efficiency analysis for sectors without well-defined input prices and/or output prices. Furthermore, since DEA and FDH are based on a best-practice frontier, each observation is compared to an efficient unit or a combination of efficient units thereby providing guidance for the inefficient units concerning which areas of their activities to improve and by how much. In this sense the efficient units can act as peers for the inefficient ones. Overall, the best-practice units will be those, which not only are efficient but also, are included at least once as peer unit for an inefficient observations. Finally, the DEA/FDH techniques are consistent with the production theoretic concept of efficiency as this is based on the maximum output for given input levels.
However, DEA and FDH have also disadvantages where some of these are specific to these methods and others are pertinent to other performance measurement techniques as well. Firstly, it is assumed that it is possible to define and measure a set of inputs and outputs for each production unit and that these appropriately characterise the production activities. Related to the input-output specification is the issue of similarity. It is important that the production units included are similar in the sense that they can be described by identical input and output categories. Otherwise, observations can be declared as efficient due to a special output/input profile, which would imply meaningless results from the analysis. This problem is parallel to the problems of outliers. Production units with an extreme production structure (e.g. specialisation into a single output) may be declared as efficient simply because of the special production structure. Possible outlier influence is increased since DEA is an extreme point technique, implying the risk that even measurement error can have significant influence. The problems of non-similarity and outlier influence can imply that it is not possible to achieve a complete ranking of the production units because relative many will be characterised as efficient (the development of super-efficiency measures can address this problem, see above). In general, there is a trade-off between a realistic description of the production profile and a complete ranking. If the efficiency analysis is based on a few number of variables then it is likely that a complete ranking can be obtained but restricting the number of variables to describe the production might not give a realistic impression of the production activities. On the other hand, inclusion of many variables will provide a more reliable description of the production activities, but this increases the possibility for specialisation and therefore makes a complete ranking less likely. This problem has been addressed in two recent studies. In Olesen & Petersen (1993) a test is developed that determines the optimal number of variables to include in a DEA analysis. Kittelsen (1992) suggests a procedure that could establish a statistical optimal data specification.

**Applications of DEA/FDH**

The DEA/FDH efficiency measures can all be calculated using special designed software such as Efficiency Measurement System (EMS) software developed by Holger Scheel at University of Dortmund, Germany. This software is for Windows 9x/NT where data can be analysed through either Excel or text-files. The only requirement to run the model is that information about inputs and outputs are available structured in accordance with the EMS requirements.

**A1. Technical efficiency score**

Technical efficiency scores can be calculated with the following inputs and outputs (these inputs/outputs are all measured in physical units). It should be noticed that other input/output specifications are possible. In particular, more disaggregated outputs could be considered, e.g. peak seat kilometres and off-peak kilometres.

Inputs: labour, fuel, materials and vehicles
A2. **Cost efficiency score**

Cost efficiency scores can be calculated with the following inputs and outputs. It should be noticed that other input/output specifications are possible. In particular, the costs could be disaggregated into labour costs, fuel costs, costs of depreciation. Also, more disaggregated outputs could be considered, e.g. peak seat kilometres and off-peak seat kilometres.

Inputs: total operating costs (costs are measured in monetary units)

Outputs: seat kilometres.

**B. Service supply**

The analysis of service supply concerns the transformation of the outputs (vehicle.km) into the service that public transport offers to the citizen considered through the concept of accessibility. This dimension can be designated as network design, where we want to evaluate the application of the outputs (vehicle.kms) to the service that public transport offers to the citizen. Too often, this step is not considered in the evaluation, and service is purely measured through vehicle.kms. The fact is that there is a high level of skill involved in designing a good public transport network, and the same quantity of vehicle.kms may be providing very different levels of service to the citizens.

We want to measure level of service in terms of potential available for the citizens, not as the actual consumption of service, which will also depend on the commercial effectiveness. For this, we use the concept of accessibility. There are many different definitions of accessibility in the literature (see for instance Chatelus, 1997), but the method proposed here can make fruitful use of several of them, as long as a higher numerical value of the index corresponds to a better level of access.

**B3. Zonal based accessibility indicator**

The first option proposed is to define accessibility for a given zone of origin and for a given time threshold as the “total mass of destinations within the urban area that can be reached within that time travelling from that zone, based on public transport plus walking”, and including consideration for waiting time and transfer times in relation to frequency of service. Mass of destinations here corresponds to the number of inhabitants and workers in each zone,
plus the daily number of visitors or clients that each facility located in that zone, taken as a potential destination, attracts.

\[ A(i) = \sum_{j|T(i,j) \leq T} M(j) \]

The choice of time thresholds is related to the size of the city, for instance 20 and 30 minutes for a medium size city, or 30 and 45 minutes for a large city.

The results obtained will vary with the zoning strategy adopted, but in all cases a relatively fine zoning of the city is required if we want to have meaningful results for accessibility on public transport. As a general rule, the “diameter” of each zone should be easily walkable, so that when a city is considered reached in a certain number of minutes no significant mistakes are made by counting the whole of its mass, irrespective of location within the zone. If data availability and computation facilities allow, this leads to the recommendation of defining zones as direct influence areas of each public transport access point (stop or station).

An alternative possibility within the same general definition of accessibility, is to use as mass of each destination zone (as “seen” from each origin zone) the number of trips with that origin and destination, as represented in the O/D matrix for all motorised modes. We should use the matrix for all motorised modes and not only for public transport, as doing this would reduce the weight of zones badly served by public transport from the origin being considered. This alternative definition requires that an O/D matrix be available, but probably reflects better the preferences for interaction between city zones, instead of summing them all up equally.

For any definition of accessibility and zoning of the urban area, a weighted average of the values thus computed for each of the zones (with its resident population as its weight) leads to an overall accessibility index of the city for that time threshold.

But simply comparing vehicle.kms with accessibility levels is not very illuminating, because accessibility values are very dependent not only on the city size, but also on the type of land use prevailing in each city. So, comparison between cities would become almost impossible. Based on this difficulty, we propose to compare results (accessibility) and outputs (vehicle.kms) based on how far each of these two variables finds itself in the real network with regard to what it might be in an “ideal” network for the same city.

Since the implicit aspiration of the public transport system in any city is to provide a service which has a quality comparable to that of the private car (and thus be in a position to fight for market share), the concept of “ideal” public transport network here is defined on the basis of this aspiration, i.e. for each user of public transport, how he would...
design the network if he needed to consider only his displacement needs. Since in this step of the evaluation process we want to concentrate on the network alone, the other features of the public transport system more directly connected to supply and accessibility (commercial speeds, frequency of service) as kept as in the real world.

So, the “ideal” public transport sub-network starting from each zone \( i \), is the one that tries to adopt the same philosophy as adopted when we travel by private car: take the quickest possible path on the available street network\(^{19} \) from \( i \) to each of those zones, at the average commercial speed of means of transport utilised and with the lowest service headway existing in that city for that transport mode. The idea here is to take the existing infrastructure as given\(^{20} \), as well as the commercial speeds and frequencies of service, trying to improve only on the design of the lines if the network was redesigned with total dedication to the best service of that zone. Naturally, on this “ideal” network there are no transfers except when changing from one mode to another.

The overall “ideal” network would be the juxtaposition of these zone-wise ideal networks, certainly with much higher supply than real networks, where compromises are made to avoid excessively low occupations. On such an ideal network, accessibility levels can still be computed with the definition given above, with the only change that travel times between two zones will be based on the ideal network, not on the real one.

B4. Zonal based supply indicator

For transport supply, we have to adopt similar measurement processes in the real and in the “ideal” systems. By analogy to what is done with respect to the accessibility index, we want to compute transport supply by zone as well as for the city as a whole. For the analysis by zone, we compute the vehicle.kms associated with the tree of quickest paths from each zone to all others in the urban area, respectively on the real network and on the “ideal” network as defined above. The city-wide supply can be defined as the (set) union of the trees obtained for all zones\(^{21} \).

Since in all links of both networks the length of the link and the frequency of service are defined, the computation of vehicle.kms / hour is straightforward and identical in both cases. Once the tree of quickest paths (from one zone to all others) is defined, the number of vehicle.kms/hour on that tree is easily computed, based on link lengths and frequencies of service.

\[
VKM/H_{\text{link}} = \text{length [km]}_{\text{link}} \times 60 / \text{headway [min]}_{\text{link}}
\]

\(^{19} \) plus the aboveground and underground rail network, admitting that turning movements were freely possible at all intersections

\(^{20} \) allowing only adjustments for nodal connections

\(^{21} \) It is interesting to note that in real networks there will be network links that do not belong to the quickest paths between any pair of zones. This may be due, either to an explicit desire for redundancy / additional capacity on some critical parts of the network, or to historical circumstances related to a line built before the opening of a new, straighter street.
The same process is then applied to the whole network, the result being much smaller than the sums of results for all zones, since there will be significant overlaps, both in the real and in the “ideal” networks.

Of course, the “ideal” network obviously corresponds to an overdose of supply and also to a better that realistically possible provision of accessibility. The purpose is to compare how much supply we are saving as we move from the “ideal” to the real system versus how much accessibility we are losing in that transition.

For our analysis, both at the zonal level and at the city-wide level, we can compute ratios for these two variables, which we may call “relative accessibility” and “relative supply”, obtaining

\[
a = \frac{A_r}{A_i} \quad \quad \quad s = \frac{S_r}{S_i}
\]

where the sub-indexes \(r\) means “real” and \(i\) means “ideal”, and then make our assessments based on a comparison of the values of these two ratios. Obviously, for similar values of \(s\), a higher value of \(a\) means we have better accessibility levels for similar levels of supply (even if we are talking of cities of different size).

If we are working at the city-wide level, we may be interested in comparing either with other cities, or between alternative network configurations for the same city. For a zone-by-zone analysis, and using the same two indexes \(a\) and \(s\) computed for each zone, we suggest to start by defining “high”, “medium” and “low” ranges in each of these variables. The following matrix of situations and corresponding interpretations can then be built:

<table>
<thead>
<tr>
<th>(a)</th>
<th>Low (Poor Accessibility from this zone)</th>
<th>Medium (Medium level of accessibility from this zone)</th>
<th>High (High level of accessibility from this zone)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(s)</td>
<td>Low Service</td>
<td>Privileged zone with respect to network design</td>
<td>Privileged zone with respect to network design</td>
</tr>
<tr>
<td></td>
<td>Poor Service</td>
<td>No particular privilege or discrimination</td>
<td>Privilege of accessibility based on supply quantity</td>
</tr>
<tr>
<td></td>
<td>Partly low supply, partly bad network design</td>
<td>Strong level of supply is largely redundant since it does not improve real accessibility</td>
<td>(and no counter-effect from network design)</td>
</tr>
</tbody>
</table>

Table 6 - Interpretation of joint values of “relative accessibility” versus “relative supply”

So, besides the overall efficiency of transformation of supply in accessibility (given by the relation of the indexes for the whole city), this zonal analysis immediately shows the relative situation of the various zones within that urban area, thus allowing an assessment of spatial distribution of quality of network design, as well as clearer ideas about where to start working to improve the situation overall.
C. Market effectiveness

C5. Public transport market share

Brief presentation

Public transport market shares identify the position of public transport modes compared to private transport in terms of attracting passengers. The advantage of market share information is that it considers the relative position (percentage public transport demand compared to the total market) rather than absolute position (public transport demand measured in passenger numbers or kilometres). In particular, disaggregated market share information is important. Zonal based market share would establish the zones where public transport has strong competitive positions. In contrast a city based average would be less relevant as information is lost in the process of averaging data across the city. Furthermore, it could be of relevance to calculate public transport market shares for specific trip purposes (e.g. commuting, business and leisure). In terms of market effectiveness it would be relevant to consider the non-captive market only, since the performance would not be dependent on the captive market (comprising persons without a travel choice). It may though be difficult to separate travel demand data into captive and non-captive segments.

Calculation principles

The public transport market share indicator can be specified as follows:

$$MS_j = \frac{PKM^{PT}_j}{PKM^{PT}_j + PKM^C_j}$$

where $PKM^{PT}$ is public transport passenger kilometres and $PKM^C$ is private transport (car based) passenger kilometres, both calculated for destination zone $j$. This indicator can be calculated for individual public transport modes as well as taking all public transport modes together. Obviously, it can be calculated at various level of aggregation, e.g. zonal level and trip purposes.

Interpretation issues

Since the ideal public transport network connecting each zone to all others was in Section B defined on a similar basis to that used for (car) private transport, it forms a suitable basis to a quantitative analysis of real versus ideal...
market share, the dimension of commercial effectiveness analyses that translates zonal accessibility levels into zonal market shares for public transport.

To be fair on the analysis, we should consider for each zone only the travellers that have a choice, i.e. those that are not captive riders either of public or private transport. Captive riders of public transport are those that do not own (or have easy access to) a private car, and captive riders of private car are those that have a complex pattern of displacements through the day that could only with great time loss be served by public transport.

A correct estimation of the dimension of these two sets is difficult by itself, but we shall not go further onto it here, except that with a note to the fact that increasing numbers of people seem to be falling on the private car-captive category at least some days of the week, as their purchasing power is allowing more complex lifestyles both for themselves and for their children.

In most cities in developed countries today, the main reason for non captive riders to opt for public transport is the difficulty and/or the price of parking. But good accessibility by public transport (in relation to that achieved by private car) constitutes a political condition for acceptability of the restrictive measures impinged on private transport. Anyway, for mathematical modelling, this means that we should not be assessing commercial effectiveness of public transport without taking into consideration the level of supply and cost of private car parking in that city.

Thus, a model of the following type can be specified to explain market share of public transport by destination zone:

\[
MS_{PT}(j) = f \left( \text{Cost of parking (j) ; } \left[ \frac{A_{PT}(j)}{A_{pc}(j)} \right] \right)
\]

where the cost of parking should include consideration for the time spent looking for a place, plus the walking time from that place to the final destination. Naturally, this cost of parking will be very different for different trip purposes, associated with different lengths of stay, which has a natural reflection on the different market shares of public transport for different trip motives, even for the same zone. So, the analysis must be segmented by trip motive (or length of stay).

The important point here is that there is a specific term in the model related to commercial performance of public transport, as the other factors are outside the control of its agents. The higher the elasticity of $MS_{PT}$ with respect to $\left[ \frac{A_{PT}(j)}{A_{pc}(j)} \right]$, the greater is shown to be the capacity of the public transport managers to take commercial advantage of their position of accessibility with regard to that by private car.
Data collection

The following information is required to calculate the public transport market share at a zonal level:

- **Passenger kilometres for public transport modes**
  Passenger kilometres are often calculated on the basis of an assumed average travel distance. These assumptions are in some cases somewhat arbitrary and may change over time. Therefore, these data should be carefully assessed. As an alternative it may be possible to use passenger numbers (or full journeys) provided average trip lengths can approximately be assumed constant.

- **Passenger kilometres for car based transport**
  Similar problems as for PT passenger kilometres would be of relevance for car based transport. As an alternative number of car based passenger trips could be used provided average trip lengths can approximately be assumed constant.

For both public transport and car based passenger demand information it may be difficult to obtain zonal information. Even passenger demand information on different trip purposes may prove problematic. This detailed information could require primary data collection through survey work and traffic counts.

Furthermore, analysis of public transport market shares with respect to costs of parking and relative accessibility would require information about:

- **Costs of parking**
  The cost of parking should include consideration for the time spent looking for a place, plus the walking time from that place to the final destination. Ideally, the information should be provided at (destination) zonal level, although in practice, only aggregated data may be available.

- **Relative public transport accessibility**
  Relative public transport accessibility could be established from the analysis of zonal based service supply and accessibility (as described above). In practice, it may be difficult to estimate accessibility indicators at a zonal level due to lack of information.

Data problems

The problem of calculating public transport market share will mainly involve:
Passenger kilometres not available

The most common problem is that no information about passenger kilometres is available, only passenger numbers. In particular, difficulties may be experienced regarding providing information on a very disaggregated level. Passenger numbers can be used as an alternative measure for public transport usage provided it can be justified that no significant changes or differences in average trip length is present.

Analysis of public transport market shares may involve problems concerning:

- Lack of sufficiently detailed zonal related information
  This concerns both costs of parking as well as relative accessibility.

- Lack of sufficiently detailed trip purpose related information
  This concerns both costs of parking as well as relative accessibility.

C6. Customer satisfaction

Brief presentation

Customer satisfaction is important in the context of market effectiveness as it can show the potential for improvement or worsening of public transport usage. A high and sustained level of customer satisfaction could be an indication that the current users are satisfied with the services provided and have no incentive to change to other modes. On the other hand low levels of customer satisfaction or significant reductions in percentage satisfied customers could indicate future problems in terms of preserving or improving current market positions.

Information about customer satisfaction/attitudes can be obtained through questionnaires/surveys among public transport users. In the context of public transport the survey should focus on identifying levels of customer satisfaction, areas of dissatisfaction, reasons for satisfaction or dissatisfaction and potential remedies. Attention could also be given to both actual users as well as potential users in order to examine perceptions of public transport among current non-users.

Calculation principles

For the performance assessment it would be useful to obtain information about the percentage of users who are satisfied or very satisfied with public transport. This could be examined both at the overall level as well as for specific aspects of public transport, e.g. cleanliness, comfort, frequency, customer care, costs, information provision etc. Furthermore, it would be relevant to undertake surveys for individual modes in order to assess modal specific issues.
Interpretation issues

The key issue with respect to assessment of customer satisfaction percentages will relate to whether the sample is representative in order to form general conclusions about public transport attitudes for the system. This can be extended to the possibility about making conclusions over time concerning changes in customer satisfaction percentages, i.e. the extent to which changes in customer satisfaction percentages are caused by actual changes concerning customer satisfaction or are due to a change in the sample composition.

Further issues relating to the use of customer satisfaction surveys over time would be that questions asked should remain identical in order to minimise the possibility that response changes are reflects actual changes and are not caused by changes in questionnaire design.

Finally, there could be an issue concerning the extent to which stated attitudes could lead to changes in travel behaviour.

Data collection

Information about customer satisfaction percentages should be obtained through questionnaires/surveys among public transport users and eventual also potential users.

Data problems

Data problems mainly relate to ensuring a representative sample and questionnaire design. In particular, a low response rate would create problems in terms of the possibility for a biased sample.

C7. Revenue per passenger kilometre

Brief presentation

Market effectiveness performance will in part be reflected in ticket revenue generated. It may seem that this is in contrast to the aim of high level of public transport usage (covered by the previous indicator), since higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc. This ingenuity can and should also extend to other aspects of market segmentation, like provision of other services related to public transport.
The indicator provides information about the average revenue generated per unit of demand (in this case passenger kilometres).

**Calculation principles**

The market effectiveness indicator (KPI9) can be specified as follows:

\[ KPI9 = \frac{R}{PKM} \]

where \( R \) is ticket revenue and \( PKM \) is passenger kilometres. This indicator can be calculated for individual public transport modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at modal level or LPTS data.

**Interpretation issues**

The following issues are of relevance with respect to the revenue generating performance indicator:

- **Market effectiveness and revenue generation**
  As noted there may be a conflict between good performance in terms of public transport usage and revenue generation because higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc.

- **Revenue generation and system performance**
  As such a high level of revenue per passenger kilometre does not alone ensure good performance of the system including high level of public transport usage. Other indicators would be required to provide a comprehensive assessment of performance.

- **Revenue comparability**
  Changes in accounting procedures for a given city may require revenue assessment comparisons to be undertaken with caution. Any results should be seen more as indicative information than definitive.

- **Aggregated performance measures**
There may be a problem of interpreting revenue per passenger kilometre measures for the LPTS as a whole comprising several modes, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus revenue generating performance and rail revenue generating performance. For example, differences between rail and bus revenue generation could be the result of different price regulation regimes.

Data collection

The calculation of the revenue performance indicator requires information about:

- **Ticket revenue**
  This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

- **Passenger kilometres**
  Passenger kilometres are often calculated on the basis of an assumed average travel distance. These assumptions are in some cases somewhat arbitrary and may change over time. Therefore, these data should be carefully assessed.

If aggregation is needed to calculate the revenue performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both revenue and output measures are available for the included sub-components. This means that a company with information only on revenue or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

Data problems

A number of problems can occur concerning the collection of information for the revenue generating indicator:

- **Ticket revenue**
  There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, there could be difficulties from accounting changes.

- **Passenger kilometres not available**
  The most common problem is that no information about passenger kilometres is available, only passenger numbers. Passenger numbers can be used as an alternative measure for public transport usage provided it can be justified that no significant changes or differences in average trip length is present.
C8 Revenue per vehicle kilometre

Brief presentation

Market effectiveness performance will in part be reflected in ticket revenue generated. It may seem that this is in contrast to the aim of high level of public transport usage (covered by the previous indicator), since higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc. This ingenuity can and should also extend to other aspects of market segmentation, like provision of other services related to public transport.

The indicator provides information about the average revenue generated per unit of public transport supply (in this case vehicle kilometres).

Calculation principles

The market effectiveness indicator (KPI10) can be specified as follows:

\[
KPI10 = \frac{R}{VKM}
\]

where R is ticket revenue and VKM is vehicle kilometres. This indicator can be calculated for individual public transport modes. In addition, it could be calculated for the LPTS as a whole, either based on data collected at modal level or LPTS data.

Interpretation issues

The following issues are of relevance with respect to the revenue generating performance indicator:

- Market effectiveness and revenue generation

As noted there may be a conflict between good performance in terms of public transport usage and revenue generation because higher prices would induce lower ridership. However, there is ample room for commercial ingenuity in the formulation and implementation of different price levels associated with different availability packages, like monthly passes, cards for a certain number of trips, single trip tickets, etc.
• **Revenue generation and system performance**

As such a high level of revenue per vehicle kilometre does not alone ensure good performance of the system including high level of public transport usage. Other indicators would be required to provide a comprehensive assessment of performance.

• **Revenue comparability**

Changes in accounting procedures for a given city may require revenue assessment comparisons to be undertaken with caution. Any results should be seen more as indicative information than definitive.

• **Aggregated performance measures**

There may be a problem of interpreting revenue per vehicle kilometre measures for the LPTS as a whole comprising several modes, e.g. bus vs. rail modes. An aggregated LPTS measure may not entail much information being an average between say bus revenue generating performance and rail revenue generating performance. For example, differences between rail and bus revenue generation could be the result of different price regulation regimes.

**Data collection**

The calculation of the revenue performance indicator requires information about:

• **Ticket revenue**

This figure should include all kinds of tickets (season tickets, multi-journey tickets, passes and so forth). It may not be possible to collect separate figures for the different modes in cities that have integrated ticketing systems.

• **Vehicle kilometres**

This figure should include route kilometres and positioning (“empty vehicle”) kilometres, but this split does not have to be specified. Often, vehicle kilometres will only be reported as route data, excluding positioning kilometres.

If aggregation is needed to calculate the revenue performance indicators for a given mode or the LPTS as a whole it is necessary to ensure that data for both revenue and output measures are available for the included sub-components. This means that a company with information only on revenue or outputs but not both, should not be included (unless it is possible to specify a reliable estimate).

**Data problems**

Data problems may include:
• **Ticket revenue**

There may be problems in relation to collection of information about ticket revenue, incl. ensuring that the data do not include any subsidy element. Furthermore, there could be difficulties from accounting changes.

• **Vehicle kilometres**

There could be a problem in getting included “empty” kilometres. Otherwise, vehicle kilometres are usually available from the relevant transport authority.

### D. Economic welfare

#### D9. Detailed cost-benefit appraisal

The key performance indicators, KPI12 and KPI13, provide together approximate information concerning the overall economic welfare implications of the existence of a public transport system (or a public transport mode within the public transport system) compared to the situation without the system. This assessment is based on the principles of welfare economic and cost-benefit appraisal frameworks.

The ideal approach should still follow within the tradition of welfare economics, but instead of the simple calculation of two key components, consumers’ surplus and producers’ surplus, the assessment should be more detailed and comprehensive.

In particular, detailed consideration should be given to:

- Identification of all relevant incidence groups taking into account geographical location, socio-economic characteristics
- Measurement of economic welfare implications for the identified incidence groups

This approach will allow assessment of the net-benefits that the various incidence groups derive from the existence of the public transport system. In this context, it would (ideally) be possible to assess the equity implications of the public transport system.

The detailed cost-benefit appraisal should give explicit attention to the environmental costs taking into account the existence of other car based modes. Ideally, this would involve consideration to at least local air pollution and noise, although other environmental aspects could also be examined.
**ANNEX 2: GLOSSARY**

**Allocative efficiency:** Relates to the production of products or services that best meet the preferences of consumers, expressed in their willingness to pay the accompanying (cost efficient) prices.

**Cost efficiency:** Relates to the production of products and services (of a specified quality) at minimum possible costs.

**Economic efficiency:** Relates to the combination of allocative and cost efficiency.

**Effectiveness:** Achieving the stated objectives. Action having an effect on producing a definite or desired result in economical terms.

**Liberalise:** to make autonomous entry to the market easier

**Deregulate:** to reduce authority rules on the actions of market suppliers

**Privatise:** sell (to individuals, stock exchange,...) former state (municipal,...) assets, such as companies

**Market competition:** Competition between multitude of companies in an open market, that struggle among them in order to get their products and services' sold, setting the prices that their costs and market enable.

**Market failure:** Situation where the market produces inefficient results due to the existence of any of the following factors:
- imperfect competition,
- natural monopoly,
- public goods,
- externalities,
- common ownership of goods,
- lack of perfect and symmetric information,
- incomplete markets.

**Market contestability:** Characteristic of certain markets in which incumbent companies are threatened by potential entrants, causing efficient results without the existence of perfect competition conditions. Baumol, Panzar and Willing (1982) hold that contestable markets guarantee the social benefits of perfect markets without the need of making
strong assumptions about the number of companies that must be operating in the market. Shepherd (1984) has observed that these results are only valid under the following assumptions:

- Entry to the market is free and without limits.
- Entry is absolute.
- Entry is perfectly reversible.

**Authority:** government or (its) administration.

**Organising transport authorities** are authorities which have powers, and may be the duty, to organise (i.e. create) passenger transport services in their jurisdiction. Transport companies in such a framework act on behalf of the transport authority.

**Regulatory transport authorities** are authorities that have some powers to regulate the actions of transport companies on the passenger transport markets. The powers of such authorities can vary considerably according to the legal framework of the country considered: from very weak regulators of the free market, to very powerful regulators with powers close to those of organising authorities. Transport companies in such a framework are considered to be independent companies (be they private or public) acting upon their own initiative on a market.

**Transport planning agencies** are specific (semi-)independent institutions created by ‘the authority’ (mostly the transport authority) to administer in a professional way a number of tasks related to the planning of transport services in the region of competence of the authority. This may include the contractualisation (possibly through competitive tendering) of transport operators. The planning functions are carried out by transport operators or directly by the transport authority when such an agency has not been created.

**Licence:** right to enter the occupation of passenger transport operator (‘operator’). A licence is granted on the basis of qualifications (concerning e.g. good repute, financial standing, professional competence) that attest the ability to be an operator. Hence, a licence concerns access to the profession.

**Authorisation:** an exclusive or non-exclusive right to operate specific services that a (licensed) ‘operator’ can apply for to a competent authority. In the case of an exclusive authorisation, other ‘operators’ are excluded from providing the same services under the same conditions. The authorisation procedure makes it possible to check whether the candidate operator fulfils all the necessary (objective and non-discriminatory) legal and administrative requirements.

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22 Remark: when referring to ‘the authority’ we do, unless stated otherwise, refer to the whole government (at the relevant, national, regional or local level) including its support staff in the form of civil servants.
**Concession:** A concession is an agreement between an authority and a (licensed) ‘operator’ of its choice whereby the authority transfers the execution of a service to the public, lying within its responsibility, to the ‘operator’ and the ‘operator’ agrees to provide the activity in return for the exclusive or non-exclusive right to operate the service or this right together with payment. A concession can take several legal forms; however, a concession is always a kind of agreement by the necessity of acceptance by the operator (although maybe very rudimentary). UK rail franchises are concessions (we prefer to limit to use of the term franchise to its usual meaning of ‘commercial brand franchises’ (e.g. McDonald's) to avoid confusions.

**Total Quality Management:** Management approach that integrates all functions and processes within an organisation in order to achieve continuous improvement of the quality of goods and services (ISO 8402). This quality management approach entail all activities of the overall management function that determine the quality policy, objectives, responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement (QUATTRO)

**Continuous improvement (ongoing improvement):** Need of continuous adjustment of the service design and processes of the provider organisation itself in order to maintain or increase its value enabling the identification of their strong and weak characteristics (QUATTRO)

**Benchmarking.** Systematic comparison of the performance of an organisation in relation with other departments/subsidiaries (internal benchmarking) or other organisations, competitors or industry leading companies (external benchmarking), as a method of sharing knowledge and experience of “best practices” to bring improvement.

**Expected quality.** Level of quality that is requested by the customer and can be defined in terms of explicit and implicit terms.

**Planned quality.** Level of quality that the company aims to provide for its passengers on the basis of its perception of the expected quality, external constraints and financial conditions.

**Realised quality.** Level of quality that is achieved on a day-to-day basis in normal operating conditions.

**Perceived quality.** Level of quality perceived, more or less objectively, by passengers in the course of their journeys.

**Customer satisfaction.** Overall level of attainment of a customer’s expectations, measurable as the percentage of the customer expectations which have actually been fulfilled.
**Partnership (travel partnership).** Agreement or series of agreements between Authorities, Contracting Bodies and Operators designed to encourage co-operation at a working level so as to improve the achievement of the business objectives of each party to the agreement but without any contractual liabilities.

**Quality partnership.** Non contractual agreement of co-operation between parties within the public and private sectors that have common interests in promoting public transport.

**Citizen’s charter.** Document explaining which services can be expected by citizens and sets out the public service’s commitments to them, whose views are taken into account when the charter is reviewed.

**Customer charter.** Document that details the commitment to the customers, sets out the standards to which the operators works, how it publishes its performance against those standards, how it looks after the customer and compensate them if things go wrong and how they can contact the operator

**Accessibility:** A standard definition of accessibility is “the ease of reaching some destinations”, and may include real or perceived costs in terms of time or money, distance travelled, level of comfort, availability and reliability of public transport, or any combination of these. In MARETOPE, the measurement of accessibility will mainly consider public transport availability.

**Allocative efficiency:** The ability to produce the right mix of outputs in terms of quantity and quality at the right prices.

**Cost benefit analysis:** A term used to describe analysis which examines options and assesses their relative merits by quantifying in monetary terms as many costs and benefits as possible, including items for which the market does not provide a satisfactory measure of value. The basis of the monetary quantification is usually willingness to accept or pay compensation for gains and losses.

**Cost-effectiveness analysis:** A term used to describe analysis which examines options which provide the same, or similar, benefits, and which assesses their relative merits by quantifying and comparing the costs of providing them.

**Criterion:** One of a number of measures against which options are assessed and compared in a *multicriteria analysis* for the degree to which they achieve objectives.
**Dynamic efficiency:** The allocation of resources across multiple time periods that maximizes the present value of net benefits from the use of the resources. In this case not only the magnitude of benefits and costs is important but also the timing.

**Economic efficiency:** The ability over time to produce the right mix of outputs in terms of quantity and quality at the right prices at the least cost, i.e. the ability to achieve allocative, productive and dynamic efficiency.

**Effects:** See impacts.

**Efficiency:** See allocative efficiency, dynamic efficiency, economic efficiency, productive efficiency, technical efficiency.

**Effectiveness:** The extent to which specified goals have been achieved. Effectiveness could refer to goal(s) achievement for an individual firm or for the whole of society. Normally, an analysis of effectiveness is limited to consider the consequences of a given production on a selected target group. This target group could comprise the whole of society. In the context of MARETOPE, effectiveness will relate to the success of attracting customers to the local public transport system both in absolute (number of passengers) and relative terms (market share).

**Industrial performance:** Performance concept concerning the transformation of inputs into outputs. As such industrial performance is identical to the term productivity (that will be used in the WP3 research).

**Impacts:** A change in the value of a variable caused by specific identifiable factors. Of particular importance would be impacts relating to controllable factors such as policy instruments, e.g. fiscal, regulatory or physical measures.

**Inputs:** Factors of production used in a production process to generate outputs. Inputs include categories such as labour, materials and capital where each of these groups could be further disaggregated.

**Multicriteria analysis:** Multicriteria analysis can be used to describe any structured approach to determine overall preferences among alternative options, where the options accomplish several objectives.

**Outputs:** The result(s) of a production process. Outputs can be categorised into intermediate outputs and final outputs. In the case of public transport an example of an intermediate output measure would be available driving hours, whereas an example of final output measures could be vehicle or seat kilometres.
**Production process:** The complex and interrelated activities through which inputs are combined and transformed into outputs.

**Productive efficiency:** The ability to produce a given mix of outputs at the minimum costs. A necessary condition (though not sufficient condition) for productive efficiency is technical efficiency (a given mix of outputs is produced with least inputs).

**Productivity:** The amount of output per unit of input achieved by a firm, industry or economy. A partial productivity measure concern output per unit of a particular factor of production (e.g. labour productivity measures). Total factor productivity involves a measure of output per unit of composite inputs.

**Public transport service supply:** The service that public transport offers to the citizens. This will be determined by the resources available to public transport, the productivity performance and the network design ability.

**Resources:** Factors that directly or indirectly are used to produce the outputs within a production process. Factors that are directly used in the production process will be termed inputs. All inputs are therefore resources but not all resources are inputs. For example, the car park facilities for the employees of a bus operating company is a resource but not an input.

**Social effects:** This impact category concern the distributional consequences of specific policy changes for the welfare of individuals and their communities. Key indicators could therefore relate to income distribution, poverty and social exclusion. In part this is related to employment and working conditions.

**Stakeholders:** Groups of people connected to one another through formally or informally defined ties, who will have something to gain or lose from a given set of actions or scenarios. In the case of MARETOPE, this concerns the various actions within the broad category of regulatory reform initiatives.

**Stakeholder analysis:** A term used to describe analysis of the impacts of actions on specific stakeholders. The analysis comprise identification of stakeholder categories, assessment of stakeholder interests and positions, consideration to the consequences of actions on stakeholders and their responses, recommendations for addressing stakeholder needs and interests.

**Technical efficiency:** The ability to produce a given mix of outputs with least inputs (or the ability to maximise the outputs for given inputs).
Utility: A term in economic theory referring to a measure of the satisfaction received from some type of economic activity (i.e., consumption of goods and services or the sale of factor services).

Welfare criterion: A change that makes at least one member of a community better off and makes none worse off is a Pareto improvement. Often the strict welfare criterion is substituted with the potential welfare improvement criterion: a change is characterised as an improvement if it is in principle possible to secure an actual Pareto improvement by linking the change with an appropriate set of transfers of money between gainers and loosers – even if in fact these transfers will not take place. The potential Pareto improvement criterion is closely linked to cost-benefit analysis (CBA) where the impacts of a given change is monetised and aggregated.

Welfare economics: The study of how the allocation of resources affects economic well-being.

Barrier: something that is causing hindrance, prevents or controls progress or movement. In an evolutionary process barriers exist all the time, they are part of a natural cause-effect dynamics. They can be visible or not limiting the decision-maker’s awareness and consequent action.

Tool: an instrument used either to mitigate or fully neutralise a barrier. Tools are not born naturally from the interactions between agents they require analyst and decision making specific intervention.

Cultural and social regime: the cultural, ideological, political and social orientations.

Legal regime: the laws to which public transport is submitted.

Regulatory regime: the general rules that are decided within the scope of the law.

Organisational forms for governance: the choice of organisational form by authorities and operators within the scope of the existing laws and regulations.

Contractual relationships: the choice of incentives (contractual relations) between actors, within the scope of laws, regulations and organisational forms.

Allocation of resources: decisions to be taken concerning conflicting allocation of budget and/or resources within the same organisation.
**Capability problems:** (stakeholders cannot support the change). These may concern the lack of instruments, personnel, skills, experience and competencies for the different stakeholders in order to implement the change process.

**Information asymmetry:** (stakeholders believe they cannot support the change). The stakeholders do not have enough / right information or perception concerning the reform process.

**Conflicting interests:** (stakeholders don't want to support the change). The reform determines advantages and disadvantages for the stakeholders that react in positive or negative way.

**Factual barriers:** these barriers are due to objectively identifiable features in the public transport regime making the realisation of its aims difficult, unlikely or illusory.

**Informational barriers:** these barriers result from a lack of information available to actors concerning the regime and its potentialities.

**Behavioural barriers:** these barriers result from subjective features in the behaviour of involved actors.

**System level:** barriers affecting the LPT System as a whole.

**Between actors level:** barriers preventing or complicating relationships between LPT actors.

**Within actors level:** barriers affecting the organisation of an individual actor.

**Strategic level:** the formulation of the aims of LPTS (general definition of policies, organisational forms of the management, and transport service characteristics).

**Tactical level:** the precise design of transport services (routes, vehicles, timetables, fares, information...).

**Operational level:** the management of the resources in the field (personnel, infrastructure and vehicles).

**Design:** during the conception of plans for change covering the perception of a certain need, opportunity or treat; the definition of strategic objectives and goals; the definition of the tactical targets; the actual design and detailing of proposals; the evaluation of alternatives; and the ultimate decision-taking regarding the implementation of the proposed change.
Implementation: during the implementation of plans, e.g. the undertaking of the necessary institutional changes enabling the implementation of the desired policy measures.

Realisation: during the stage after the implementation of plans in which the results of change become evident.

Sequences of barriers: a barrier can induce other ones.

Sets of barriers: barriers coexisting and reinforcing each other.

Process tool: it will improve adaptation to the defined change. A process tool could be e.g. a measure that facilitates the exchange of information between layers of government. It was thought that such tools might overcome factual barriers, informational barriers or behavioural barriers.

Resource tool: it will improve the financial situation and/or the capacity of the actors and/or the LPTS. It was hypothesized that resource tools would often, but not always, be designed to overcome factual barriers. Tools which increase the competencies or the knowledge of an agent should be referred to as process tools.

Framework tool: it will change the rules of the game, including governance and contractual arrangements. The hypothesis was that framework tools in many cases would be designed to overcome factual and informational barriers. Tools which are designated to smoothen the adaptation to the defined change, i.e. to improve or clarify the rules of the game, but not to change them, should be referred to as process tools.

Closed Market: (temporally undetermined monopoly) operators are protected by exclusive rights and no elements of competition are in force;

Controlled Competition: (competition for the market) the awarding of exclusive rights (lasting for finite periods) is undertaken through tendering procedures open to all competing operators;

Deregulation: (competition in the market) there are no exclusive rights and public transport is driven by market forces.
## Annex 3 – Key Performance Indicators in MARETOPE Case Studies

<table>
<thead>
<tr>
<th>LPTS (1990/2000)</th>
<th>KPI 1</th>
<th>KPI 2</th>
<th>KPI 3</th>
<th>KPI 4</th>
<th>KPI 5</th>
<th>KPI 6</th>
<th>KPI 7</th>
<th>KPI 8</th>
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<th>KPI 10</th>
<th>KPI 11</th>
<th>KPI 12</th>
<th>KPI 13</th>
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<tbody>
<tr>
<td><strong>Improvement of quality and efficiency</strong></td>
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<td>2.8%</td>
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<td>-8.3%</td>
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<td>-17.0%</td>
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<td>-29.5%</td>
<td>n.a.</td>
<td>21.3%</td>
<td>5.8%</td>
<td>9.2%</td>
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<td>0.9%</td>
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<td>-11.8%</td>
<td>8.9%</td>
<td>n.a.</td>
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<td>1.9%</td>
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<td>-51.5%</td>
<td>n.a.</td>
<td>n.a.</td>
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<tr>
<td>Plurality of operators</td>
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<td>-10.4%</td>
<td>18.6%</td>
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<td>44.9%</td>
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<td>26.4%</td>
<td>21.2%</td>
<td>4.0%</td>
<td>-10.4%</td>
<td>1.8%</td>
<td>9.4%</td>
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<td>97.9%</td>
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<td>14.3%</td>
<td>-35.9%</td>
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**Notes:**
- KPI: Key Performance Indicator
- LPTS: Life Period Time Span
- n.a.: Not Available
- %: Percentage

**Organisational forms:**
- Public ownership
- Private concessions
- Regulated authorisations
- Open entry

**Authority initiative:**
- ‘Concessions’

**Market initiative:**
- ‘Authorisations’

**Management:**
- Authority initiative: Dominated by public companies
- Market initiative: Dominated by private companies

**LPTS (1990/2000):**
- KPI 1: Improvement of quality and efficiency
- KPI 2: Organisational reform
- KPI 3: One operator
- KPI 4: Plurality of operators
- KPI 5: From market initiative
- KPI 6: Controlled Competition
- KPI 7: Deregulation

**Performance Indicators:**
- Improvement of quality and efficiency
- Organisational reform
- One operator
- Plurality of operators
- From market initiative
- Controlled Competition
- Deregulation