Final Report for Publication

EUROSIL

EURopean Strategic Intermodal Links

Contract SC-1131

Project Coordinator: **National Technical University of Athens (Greece)**

Partners:

Steierwald Schönharting und Partner GmbH (Germany)
Heusch/Boesefeldt (Germany)
VTT Communities and Infrastructure (Finland)
SK-Consulting (Finland)
IVV-Aachen (Germany)
WS ATKINS Consultants Ltd. (Great Britain)
STRATEC S.A. (Belgium)
SGI (France)
EUROTRANS (Great Britain)
IMPETUS (Greece)
STASA (Germany)
TECNIC (Italy)
KRUPP (Germany)
Netherlands Economic Institute (Netherlands)
University of Newcastle upon Tyne (Great Britain)
University of Cologne (Germany)
University of Dortmund (Germany)
TRANSMAN (Hungary)
MARIMEX (Bulgaria)

Project Duration: 01/01/97 to 31/10/99

Date: 31.01.2000

PROJECT FUNDED BY THE EUROPEAN COMMISSION UNDER THE TRANSPORT RTD PROGRAMME OF THE 4th FRAMEWORK PROGRAMME

TABLE OF CONTENTS

LIST OF FIGURES

THE EUROSIL CONSORTIUM

Partner	Participation Status	Contact person	Phone	Fax	E-mail
NTUA	Project Coordinator	Prof. Maria Giaoutzi	+30-1-7722749	+30-1-7722750	giaoutsi@central.ntua.gr
		Dr. Anastasia Stratigea	+30-1-7722672	+30-1-7722750	stratige@central.ntua.gr
		Ms. Zenia Dimitrakopoulou	+30-1-7722672	+30-1-7722750	zenia@survey.ntua.gr
SSP	Contractor	Dr. Lothar Neumann	+49-711-906980	+49-711-9069888	mail@stgt.ssp-consult.de
H/B	Contractor	Mr. Nicolas Grosch (AVISO)	+49-241-4703584	+49-241-9010969	Nicolas.Grosch@avisogmbh.de
		Mr. Dieter Sage	+49-241-9669212	+49-241-9669155	Dieter.Sage@vup.heuboe.de
VTT	Contractor	Dr. Wladimir Segercrantz	+358-9-4564596	+358-9-464174	Wladimir.Segercrantz@vtt.fi
SK	Contractor	Mr. Reijo Helaakoski	+358-9-7742320	+358-9-77423211	rhe@skolmio.fi
IVV	Contractor	Dr. Dirk Serwill	+49-241-9469177	+49-241-531622	ser@ivv-aachen.de
TRENDS	Contractor	Dr. George Argyrakos	+30-1-2110227	+30-1-2289943	trendsgr@compulink.gr
ATKINS	Contractor	Dr. Andy Southern	+44-1372-726140	+44-1372-740055	jlsmith@wsatkins.co.uk
STRATEC	Contractor	Mr. Hugues Duchâteau	+322-7350995	+322-7354917	h.duchateau@stratec.be
SGI	Associated Contractor	Ms Argyro Filiou	+30-1-6282856	+30-1-6282854	afiliou@sgihellas.gr
ETC	Associated Contractor	Mr. Manos Vougioukas	+44-181-2961885	+44-181-8915027	eurotrans@atlas.co.uk
IMPETUS	Associated Contractor	Mr. Stelios Efstathiathis	+30-1-4833673	+30-1-4836807	impetus@compulink.gr
STASA	Associated Contractor	Prof. Günter Haag	+49-711-4790181	+49-711-478183	haag@sofo.uni-stuttgart.de
TECNIC	Associated Contractor	Mr. Vassilis Kallidromitis	+39-06-85355088	+39-06-85355096	tecnic.spa@agora.stm.it
KRUPP	Associated Contractor	Mr. Uwe Sondermann	+49-201-8284874	+49-201-8284620	sondermannk@kf.krupp.com
NEI	Associated Contractor	Mr. Jan van Ginkel	+31-10-4538793	+31-10-4523680	ginkel@nei.nl
NCLU	Associated Contractor	Dr. Corinne Mulley	+44-191-2226567	+44-191-2228352	Corinne.Mulley@ncl.ac.uk
UoC	Associated Contractor	Dr. Karl-Josef Höhnscheid	+49-221-4702335	+49-221-4705183	K.J.Hoenscheid@Uni-Koeln.de
IRPUD	Associated Contractor	Prof. Michael Wegener	+49-231-7552401	+49-231-7554788	mw@irpud1.raumplanung.uni-dortmund.de
TRANSMAN	Associated Contractor	Dr. Janos Monigl	+361-3531484	+361-3110265	transman@transman.hu
MARIMEX	Associated Contractor	Mr. Petar Makariev	+3592-720260	+3592-720260	marimex@gti.bg

0. EXECUTIVE SUMMARY

The need for better practice

Whilst many of the appraisal procedures for informing decisions on transport investments are well established, the extent to which intermodal, multimodal and interoperable transport interventions contribute to Area Development is less well understood and consequently decision-making tools are less well developed.

The overall aim of EUROSIL, therefore, is the development of reliable and comprehensive guidelines to support decision making processes with respect to impacts of Intermodality, Multimodality and InterOperability (often abbreviated in this report by 'IMO') on Area Development in the context of the Trans-European and Pan-European Networks.

The objectives are to provide practical assistance to actors involved in transport project appraisal by:

- providing examples of current practice in intermodal, multimodal and interoperable transport projects to assist in fulfilling the understanding of the potential benefits achievable. The project has drawn extensively on a series of case studies to provide valuable evidence on current practice across the Community and parts of Eastern Europe;
- providing guidelines that facilitate best practice being applied in the further development of intermodal, multimodal and interoperable transport projects thereby advancing current practice;
- providing guidelines to assist in the identification and assessment of the potential Area Development impact achievable through improved accessibility arising from intermodal, multimodal and interoperable transport projects.

The guidelines consist of recommendations on the identification, measurement and evaluation of these impacts drawing on state of the art approaches currently being applied and best practice.

The Final Report comprises five chapters. **Chapter 1** provides an overview of the project including the objectives and the structured approach. **Chapter 2** summarises the role of IMO in existing policy frameworks and explains the rationale for IMO in terms of the potential added value that IMO can provide over and above uni-modal transport systems. Conversely, this Chapter also identifies the potential barriers to IMO. **Chapter 3** describes current practice in assessing the added value of IMO drawing heavily on case study analysis. Importantly this Chapter reports the project's views on shortcomings in the assessment of IMO and Area Development and explains consistently why there is a need for best practice guidelines to aid decision-making and impact assessment for IMO transport interventions. **Chapter 4** provides a series of guidelines for the identification, measurement and evaluation of those features of IMO transport projects that represent the added value and in turn contribute to Area Development. **Chapter 5** provides the conclusions with regard to the guidelines given.

EUROSIL concludes, there is a need for better practice in assessing the added value of the impacts of IMO and its influence on Area Development.

This need for better practice is founded on a combination of:

- the increasing emphasis placed on IMO in the evolution of the TEN and PEN and the contribution of transport to economic development and social inclusion;
- evidence, that there is real added value associated with IMO in terms of improvements in the quality of transport and accessibility;
- the shortfalls in current practice in capturing this added value in the assessment and therefore decision-making process.

The European Union has placed increasing emphasis on the evolution of the Trans-European and Pan-European transport networks (TEN and PEN) during the last decade. A key feature of TEN/PEN development is the emphasis on multimodal, intermodal and interoperable networks. Apart from the broader sustainable mobility objectives another important objective of these interventions is to achieve improved accessibility which, when applied in an appropriate manner, supports Area Development leading towards a more spatially balanced economic development and improved social cohesion. This aspect is particularly important for peripheral areas in Western Europe, as well as for the countries of Eastern Europe in the light of the future accession to the Community.

The Commission's transport policies are aimed at improving interoperability in conjunction with the development of intermodal and multimodal door-to-door transport, and thereby seek to promote a greater use of environmentally friendly modes of transport with spare capacity. By improving the potential for these modes and by offering effective alternatives to single-mode road journeys, intermodality supported by interoperability will help to overcome congested road networks as well as improve the efficiency in the operation of the transport system as a whole.

Whilst IMO is encouraged in policy terms, ultimately its value to transport efficiency and Area Development is dependent on rigorous examination to ensure, that the potential added value is likely to be delivered. The investigations of the EUROSIL case studies work revealed, that this added value exists. The potential for added value exists through:

- Multimodality and Intermodality on Transport Systems Performance,
- Interoperability on Intermodality and Transport Systems Performance and
- Multimodality, Intermodality and Interoperability on Area Development (both directly or "via" improved Transport System Performance).

However, the EUROSIL case studies also showed, that even those projects aimed at investigating IMO schemes need comprehensive guidance already at an initial stage covering all relevant aspects (such as properties and impacts to be covered, actors to be considered or measurement / modelling peculiarities arising) relevant to determining the impacts of IMO on Area Development. This applies in particular to Area Development effects given the greater uncertainty over materialising them and with the difficulties in identifying them.

Moreover, the work of EUROSIL also revealed that there is still a number of obstacles which prevent the extensive use of intermodal transport. These include the lack of a coherent network of modes and interconnections, the lack of technical interoperability between and within modes, a variety of regulations and standards for transport modes, data-interchange and procedures. There are varying levels of performance and service quality between modes, different levels of liability and a lack of information about intermodal services.

In summary, the state of the art shows that whilst IMO and Area Development benefits are often claimed these are usually not sufficiently defined (including impacts by different actors etc.), measured or evaluated. For example, the examination of the modelling approaches used in the 12 EUROSIL case studies revealed that only a minority of the modelling approaches adopted explicitly dealt with representing Area Development IMO effects in a detailed manner. Most of the models employed in the case studies do not explicitly address some of the fundamental requirements of assessing the Area Development impacts of multimodality, let alone intermodality and interoperability. Moreover, many of the transport models being used in the case studies do not have the full technical specification to address transport system impacts of intermodality and interoperability.

Under these premises, it is important to ensure that the potential benefits of intermodal transport facilities are

- identified,
- measured and
- captured in the evaluation process

ideally on a consistent basis.

Hence, there is a **strong need for guidelines on how to do this**, in order to assist a decision maker in assessing intermodality, multimodality and interoperability and the influences on Area Development in a comprehensive way. In response to that need, EUROSIL provides a series of guidelines and recommendations.

Guidelines

The report focuses on the elaboration of an evaluation framework for assessing the IMO impacts on Area Development in the context of TEN and PEN.

The evaluation process has been developed into a EUROSIL oriented Evaluation Framework, which enables a structured approach to the assessment of IMO impacts on Area Development:

- the Evaluation Criteria Development Process (Stage I),
- Modelling / Measuring / Estimating the Dynamics (Stage II) and
- the Evaluation / Assessment Process (Stage III).

Each stage comprises one or more major steps which are summarised below:

♦ **Define Objectives and Actors**	**Stage I**
♦ **Identify relevant properties**	**Stage I**
♦ **Identify impacts / indicators**	**Stage I**
♦ **Define Measurement units**	**Stage I**
♦ **Measure / Estimate dynamics**	**Stage II**

- ♦ **Select evaluation method** **Stage III**
- ♦ **Determine measurement type** **Stage III**
- ♦ **Assign Values and Weights** **Stage III**
- ♦ **Compare alternatives** **Stage III**

The **Evaluation Criteria Development Process** – Stage I of the Evaluation Framework – combines four steps:

- Definition of the full range of **actors** with an interest in the project and the **objectives** underpinning the project;
- Identification of a set of **properties**, related to the project specific interests and objectives;
- Identification of **impacts** producing the necessary or desired indicators to be considered in the subsequent evaluation process;
- Definition of the indicators in terms of **precise measurement units**.

The **Modelling/Measuring/Estimating the Dynamics** – Stage II – seeks to provide a quantification of the impacts per alternative in terms of changes in indicators. An important aspect of this stage is the emphasis on methods and tools for modelling IMO transport improvements and Area Development aspects as input to decision-making on implementation and investment issues.

The following guidelines are proposed for the modelling framework assessing the Area Development impacts resulting from IMO enhancements:

- An **overall modelling framework** is required which includes **both land use and transport model components**, ideally in a composite structure, which effectively comprises separate land use and transport sub-models with inputs and outputs linked in an overall iterative structure;
- The **land use (sub-)model** should employ the generalised costs from the transport model in some form which enables **land use impacts to be directly influenced by changes in the transport system**, such as improvements in intermodality or interoperability;
- The use of a network-based representation of **alternative routes and modes within the transport (sub-)model** is considered essential. The network model should employ appropriate multi-pathing algorithms to construct alternative routes through the network between origin-destination pairs;
- The transport (sub-)model should employ some form of **choice model** which estimates the **demand on each mode combination/route** based on the generalised costs of the different alternatives;
- The generalised cost formulation used in the transport (sub-) model should include an **explicit representation of costs of modal transfer**.

As a link between Stages II and III it is essential to understand the significance of the magnitude of changes in measured indicators as a result of investments (impacts).

The third stage of the framework deals with the **evaluation / assessment process**:

- The first step is the selection of the **appropriate evaluation method**.

- This influences the **measurement types** (e.g. ratio, monetary, ordinal, qualitative) that can be used in the evaluation process.
- A further important step of stage III is the assignment of **values and weights** to the evaluation criteria taking into account that these may vary by actor and over time. This is particularly important for IMO projects and Area Development impacts where a wide range of actors are likely to be involved.
- The final major step is the **comparison** of the different alternatives under investigation on the basis of the information analysed as part of the evaluation process.

The use of an appropriate evaluation framework presenting a systematic generation of alternatives, the definitions of objectives and evaluation criteria and the selection of appropriate evaluation techniques will greatly support decision-making in resolving issues of conflicting views on locational options, priorities in implementation of plans, IMO enhancements options etc., so that policy makers are able to take account of all performances of planning strategies.

In this context both Cost-Benefit Analyses (CBA) and Multi-Criteria Analyses (MCA) can be used in a complementary way, since CBA is bound to monetary values while MCA to qualitative aspects, as well. However, the great number of actors involved in IMO projects and the nature of the properties and impacts describing the effects on the transport system and the Area Development call for case specific selection of evaluation methods.

The monetarising process includes all the disadvantages imbedded in CBA, such as dependence on a correct monetarising method, conversion of monetary values in market prices, referencing of alternatives to universal background, etc. This restricts heavily the usefulness of CBA as a sole method in the context of evaluating IMO impacts on Area Development, where a broad range of qualitative attributes is involved. However, when the performance of Cost-Benefit Analysis is legally binding for large public investments, there is the need to cover the specific aspects of IMO and Area Development in the monetarising process. If this is not possible, these aspects must be covered adequately in the description of the intangibles.

MCA in this respect is able to cope with a wider system of objectives and criteria that could be based on social and economic welfare. The ability of MCA to cope with conflicting views as well (variety of actors!) provides decision-makers with a sound tool for the evaluation of IMO and Area Development.

The EUROSIL **evaluation framework** provides comprehensive guidance as a practical support for decision-makers with respect to evaluation / assessment of Area Development aspects of IMO projects.

Towards this direction an approach has been developed that assists the person in charge in selecting the “right” properties (KEP). The modelling framework provides support for selecting the appropriate models for the assessment of cardinal (quantifiable) evaluation criteria, while for the rest of the properties (qualitative or mixed) a set of appropriate methods has been provided.

The EUROSIL guidelines provide the basis for constructing comprehensive evaluation tools for capturing the added value of IMO and their effects on Area Development. The additional complexity associated with capturing this added value is generally not included within “standard” evaluation tools.

EUROSIL provides guidelines and software facilitating an interface between the identification of IMO related properties, indicators and impacts and standard evaluation software.

EUROSIL also concludes from a pilot exercise by applying elements of the EUROSIL evaluation framework within a standard decision support software package that there is scope for further user friendly developments of evaluation software to make this more appropriate to evaluation issues likely to be confronted when considering IMO and their Area Development impacts in the TEN and PEN context.

In cases where the decision-maker / person in charge will not apply a “sophisticated” evaluation but rather a quick assessment of different alternatives, a “manual for simplified property rating” has been constructed. This aims at supporting decision-makers in estimating or assessing the possible effects of IMO on Area Development whenever time, money or experience is lacking.

1. INTRODUCTION TO EUROSIL

1.1 THE OBJECTIVES OF EUROSIL

The European Union has placed increasing emphasis on the evolution of the Trans-European and Pan-European transport networks (TEN and PEN) during the last decade. This has increased the need for sound instruments, which support investment decision-making processes and assist in determining which interventions in the TEN best contribute to the broader economic, social and environmental objectives.

A key feature of the TEN development is the emphasis placed on multimodal, intermodal and interoperable networks. Likewise an important objective of these interventions is improved accessibility and Area Development.

Whilst many of the appraisal procedures for informing decisions on transport investments are well established, the extent to which intermodal, multimodal and interoperable transport interventions contribute to Area Development is less well understood and consequently decision-making tools are less well developed.

The overall aim of EUROSIL, therefore, is the development of reliable and comprehensive guidelines to support decision making processes with respect to impacts of multimodality, intermodality and interoperability on Area Development in the context of the Trans-European and Pan-European Networks.

The objectives are to provide practical assistance to actors involved in transport project appraisal by:

- providing examples of current practice in intermodal, multimodal and interoperable transport projects to assist in fulfilling the understanding of the potential benefits achievable. The project has drawn extensively on a series of case studies to provide valuable evidence on current practice across the EU and parts of Eastern Europe;
- providing guidelines that facilitate best practice being applied in the further development of intermodal, multimodal and interoperable transport projects thereby advancing current practice;
- providing guidelines to assist in the identification and assessment of the potential Area Development impact achievable through improved accessibility arising from intermodal, multimodal and interoperable transport projects.

The guidelines consist of recommendations on the identification, measurement and evaluation of these impacts drawing on state of the art approaches currently being applied and best practice.

1.2 INTERMODALITY, MULTIMODALITY AND INTEROPERABILITY (IMO)

Throughout the project, a consistent interpretation of Intermodality, Multimodality and InterOperability (often abbreviated in this report by 'IMO') has been adopted:

- **Multimodality**: as a characteristic of the transport system which reflects the competition between transport modes in the same corridors. The mode choice issue here will be considered for all relevant travel modes and travel purposes taking into account the issues of congestion in crucial corridors and/or modes, as well as the presence of information (i.e. transport telematics).
- **Intermodality**: as a characteristic of the transport system which allows the use of at least two different transport modes for a single trip (i.e. a route serving passengers and/or goods using more than one travel mode for the same travel purpose). Also, a trip may be defined as being intermodal where it uses at least two different modes from origin to destination. Intermodality has to consider the location of terminals, transfer points and interconnections (interfaces) with the scope to minimise the ”resistance” of the integrated transport chain, as a whole.
- **Interoperability**: as a quality of two or more interacting transport systems which allows the provision of an acceptable level of service by intermodal transport for the route, node or corridor under consideration and/or the use of the same mode services which are provided by different operators/actors. Organisational arrangements (especially for terminals and transfer points) and removal of institutional, financial, physical, technical, cultural and political barriers are the means used to this end. Particular emphasis is given to optimisation of the interfaces between Trans-European and urban networks.

Other EC research studies have adopted various similar definitions of IMO. These include:

- **Intermodality** (1) is a characteristic of a transport network which allows the use of at least two different transport modes for at least one single trip from origin to destination.
- ***Intermodality*** *(2) also is a characteristic of a trip which uses at least two different transport modes from origin to destination.*
- ***Intermodality*** *(3) also is a characteristic of a nodal point which allows transfer between at least two different transport modes.*
- ***Multimodality*** *is a characteristic of a transport network in which at least two modes compete for taking trips in the same corridor.*
- ***Interoperability*** *is the quality of two or more transport systems, describing the ability of offering harmonised interfaces and thus easy access to operators and an acceptable level of service. Interoperability reduces barriers between transport systems (e.g. institutional, financial, physical, technical, cultural or political barriers). Operators may be either (1) service providers who operate on a network (e.g. airlines, DIR 91/440 railway-operators) or (2) end users who operate on a network (e.g. vehicle drivers) or use a service (e.g. train passengers, vehicle drivers on toll roads).*

Importantly, multimodality and intermodality are defined as characteristics of the transport system, that, moreover, can coexist. Similarly, interoperability is defined as a quality of two or more interacting transport systems including multimodal and intermodal systems. Hence, transport systems often possess more than one of the IMO characteristics/qualities pertinent to EUROSIL.

1.3 AREA DEVELOPMENT AND ITS RELATIONSHIP TO IMO

Area Development has been defined and applied consistently throughout the project as the structural changes in the scale and type of land-use (industrial, commercial, residential, retail and leisure) as well as in the pace of economic activities on a regional and sub-regional level. Economic activity and land-use development in an area is influenced by a range of factors including environmental attractiveness, accessibility and, partly as a result of the first two, land values (Linekken 1997). Transport improvements and specifically change in transport performance through IMO can lead to improvements in accessibility, contributing in turn to changes in the scale, type and pace of economic and land-use development. Also, physical infrastructure facilities as part of IMO (particularly intermodal facilities such as interchange and transhipment centres) contribute to Area Development directly. On the other hand, transport demand and travel conditions are clearly influenced by economic activity and land-use development.

There is, thus, a two-way interaction between Area Development and transport as illustrated in Figure 1.1. The relationship is a loop in which Area Development creates more demand for travel and transport provision, which then leads to changes in accessibility which in turn influences Area Development.

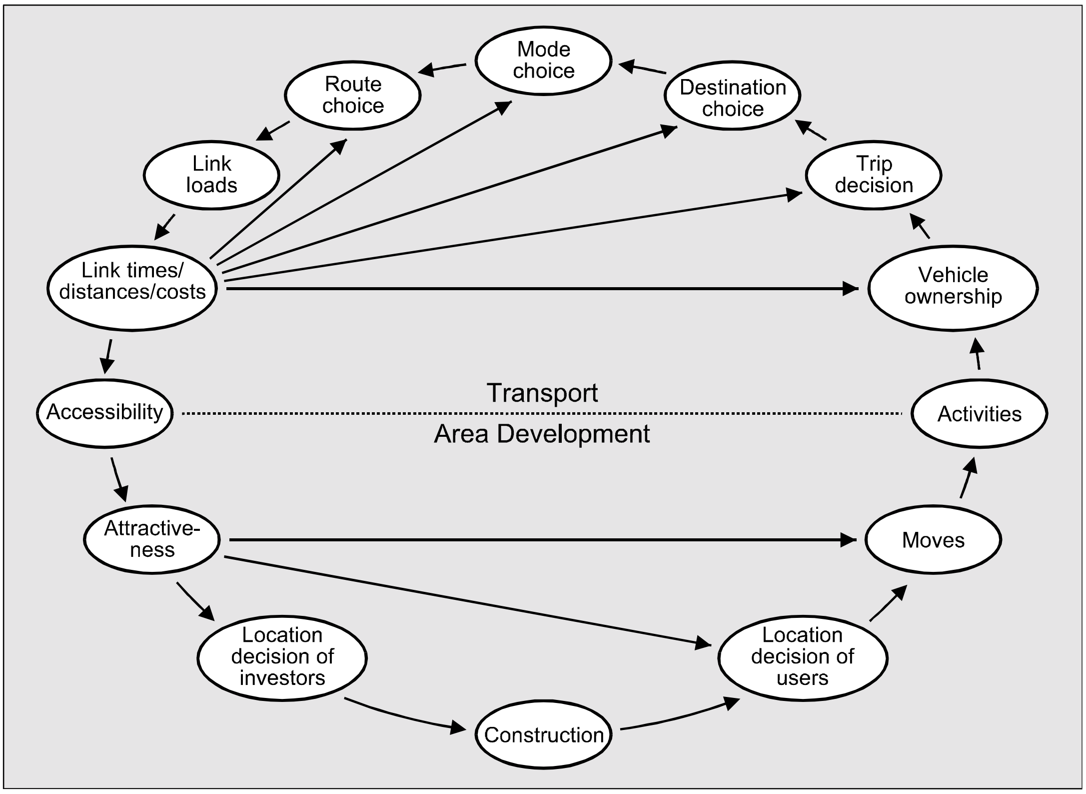

Figure 1.1: Transport and Area Development

The greater the extent to which IMO influences transport conditions and choice – and hence accessibility – the greater the linkage between IMO and Area Development.

1.4 THE PROJECT APPROACH

As shown in Figure 1.2 the project was undertaken in three main phases of work:

- Exploratory Phase in which the structure and process for identifying and analysing IMO impacts was developed.
- Investigative Phase in which twelve case studies have been examined to provide a detailed understanding of current practice in the assessment of IMO and impacts on Area Development.
- Evaluation Phase in which guidelines have been developed taking account of evaluation requirements and shortfalls in current practice for identifying, measuring and evaluating the IMO impacts on Area Development.

The contents of each Phase are summarised as follows:

1.4.1 Exploratory Phase

Assessment of recent experience (Deliverable 1)
- Overview of the state of the art in intermodal transport
- Assessment of the impacts from major European projects over the last few years
- Identification of key problems for the overall project

Identification of key indicators (Deliverable 2)
- Definition of a common set of potential indicators for measuring the extent to which transport projects meet their objective
- Definition of the relevant actors
- Proposals on the selection process for the case specific key indicators.

Existing Methods for the Assessment of Strategic Impacts (Deliverable 3)
- Definition of a range of impacts associated with strategic intermodal transport projects
- Identification and review of existing methods for assessing strategic impacts
- Determination of the type of strategic impact requiring investigation in the EUROSIL case studies
- Development of a methodology to enable consistent examination of strategic impacts

1.4.2 Investigative Phase

Fine-tuning process of case studies (Deliverable 4)
- Provision of a structured overview of the nature of each case study
- Assessment of the degree of compliance of the case studies, at the initial stage, with EUROSIL objectives

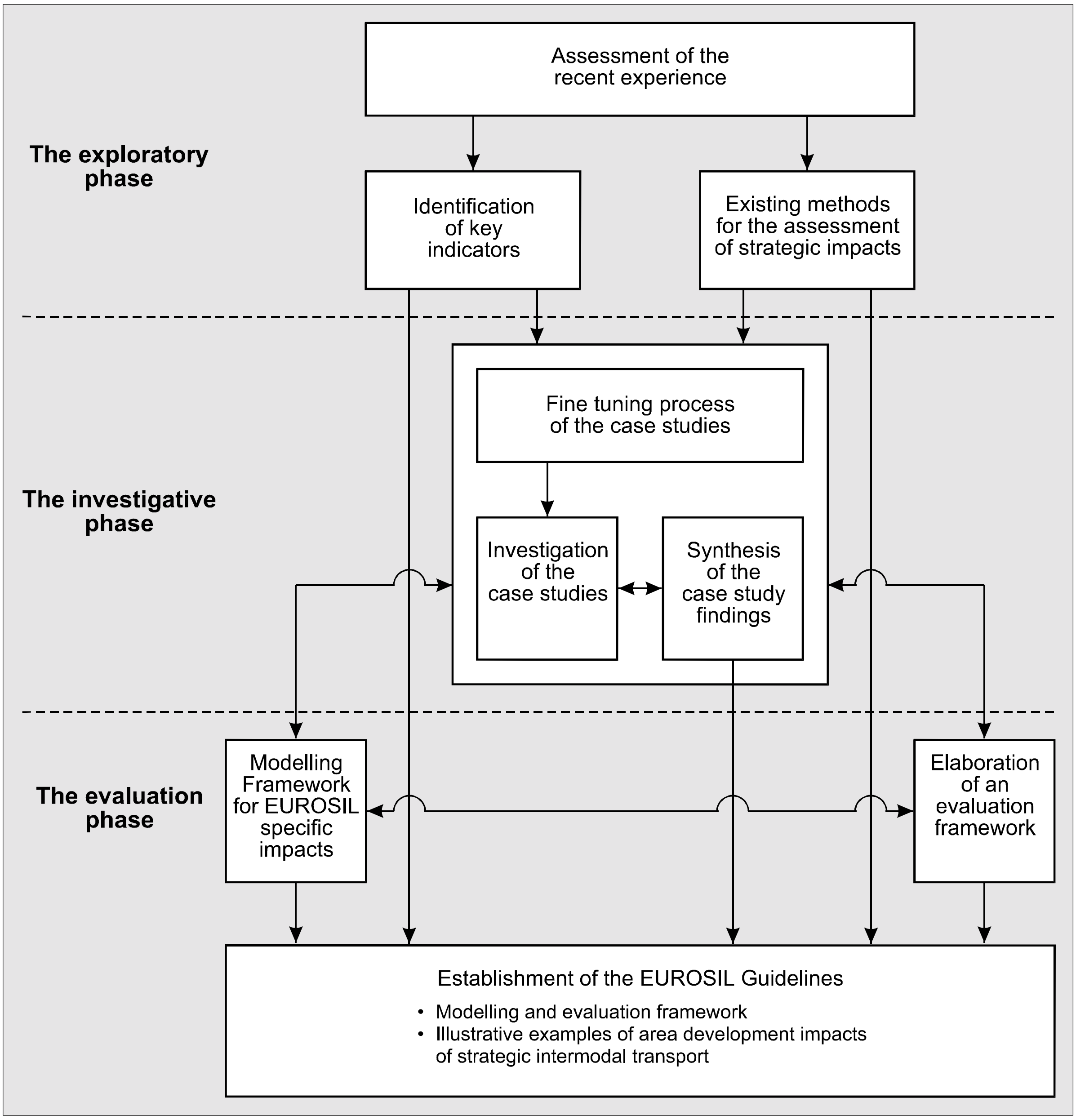

Figure 1.2: Structure of the EUROSIL approach

Investigation of the case studies (Deliverable 6 and Internal Working Papers))

- Identification and analysis of the relevant issues, problems, goals and potential transport solutions.
- Adaptation or modification of methods and models
- Testing of hypotheses regarding the impacts of intermodal transport investments
- Critical examination of the EUROSIL specific aspects (e.g. methods and models applied to the case studies)

Synthesis and conclusions on the case studies (Deliverable 6)

- Summarising the case study results
- Synthesis of the Area Development impacts of intermodal transport
- Synthesis of the added value offered by multi-modality, intermodality and interoperability
- Synthesis of the limits and barriers of multi-modality, intermodality and interoperability

1.4.3 Evaluation Phase

Modelling Framework for EUROSIL Specific Impacts (Multimodality, Intermodality, Interoperability, accessibility and Area Development Impacts of transport infrastructure) (Deliverable 7)

- Assessment of methods and models used in the case studies
- Identification of modelling requirements for appraising the Area Development impacts of intermodal transport schemes
- Assessment of existing models and tools for appraising Area Development impacts

Elaboration of an Evaluation Framework (Deliverable 8)

- Identification of appropriate methods and criteria for the appraisal of intermodal transport schemes
- Development of a Spatial Evaluation Framework

Establishment of the EUROSIL Guidelines (Deliverable 9/10)

- Identification of consistent methods for common application to the appraisal of strategic intermodal transport
- Recommendations on the structure and content of a modelling and evaluation framework

EUROSIL has focused on strategic transport issues of relevance to the TEN and PEN developments. In terms of overall scope EUROSIL covers the following **topics**:

- Passenger and Freight Transport.
- Travel Modes (road, rail, air, waterborne including short sea shipping and inland waterways, and pipelines).
- Infrastructure and networks, taking into account not only existing but also new elements of all networks (communication, information, etc.).
- Organisational structure, with the consideration of the legal and institutional framework and the level of regulation and harmonisation.
- The requirements of potential end users (e.g. passengers) and intermediate users (e.g. operators, customers) and public authorities.
- The economic and financial issues, i.e. allocation of infrastructure and external costs, tax regimes (including tolls and other forms of pricing) and return of investment.
- The impact of new technologies, including information technology and transport telematics tools as well as the application of new transport technologies especially for the transfer of goods.

1.5 THE ROLE OF THE CASE STUDIES IN THE EUROSIL APPROACH

The EUROSIL approach has used as a corner stone 12 illustrative case studies – as shown in figure 1.2 – representing the state of the art of "real world approaches" to IMO in different circumstances. The investigations carried out within the case studies are used to provide information on the current state of the art and to identify best practices. In order to elaborate the specific knowledge on the treatment of IMO and identification of links to Area

Development, the approaches and methodologies developed in phase 1 of the project were applied within the investigations and were thus used to provide feed-back to the evaluation phase. Generalised questionnaires were used to extract specific information on methodologies, approaches and results, as well as, on the other hand, on the added value of multimodality, intermodality and interoperability (IMO) and the identification of Area Development aspects.

The case studies of EUROSIL are Strategic Intermodal Links (SIL), which build parts of the Transeuropean and Paneuropean Networks for Transport. Most of the case studies refer to interurban links but some of them are located in a peri-urban context, in order to deal with the aspects of TEN and PEN on regional access. The list of the EUROSIL case studies and their location on the map of Europe are shown in the table of Fig. 1.3 and on the map of Fig. 1.4 respectively.

ACRONYM	**NAME**	**COUNTRIES INVOLVED**	**TYPE**
1. SILET	Strategic Intermodal Link EuroTunnel	UK – France – Belgium	International – Interurban
2. SILAH	Strategic Intermodal Link Austria Hungary	Austria - Hungary	International – Interurban
3. SILC	Strategic Intermodal Link to Caspian Sea	Greece - Bulgaria – Russia	International – Interurban
4. SILAF	Strategic Intermodal Link Airport and Freight Transport	Germany - (B, F, NL)	International – Interurban
5. SILAP	Strategic Intermodal Link Airport and Passenger Transport	Germany	Interurban
6. SILFIR	Strategic Intermodal Link from Finland to Independent Republics	Finland - Russia	International – Interurban
7. SILBA	Strategic Intermodal Link Barents Euro-Arctic Transport Corridor	Finland - Sweden – Norway - Russia	International – Interurban
8. SILUB	Strategic Intermodal Link Urban Area of Brussels	Belgium	Urban
9. SILFAS	Strategic Intermodal Link Fast Handling Systems	Germany	Urban Interurban
10. SILUS	Strategic Intermodal Link Urban Area of Stuttgart	Germany	Urban
11. SILNOW	Strategic Intermodal Link North-Western Macroregion of Italy	Italy	Interurban
12. SILIRE	Strategic Intermodal Link Ireland	Ireland	Urban / Peri-urban

Figure 1.3: The EUROSIL Strategic Intermodal Links (SIL)

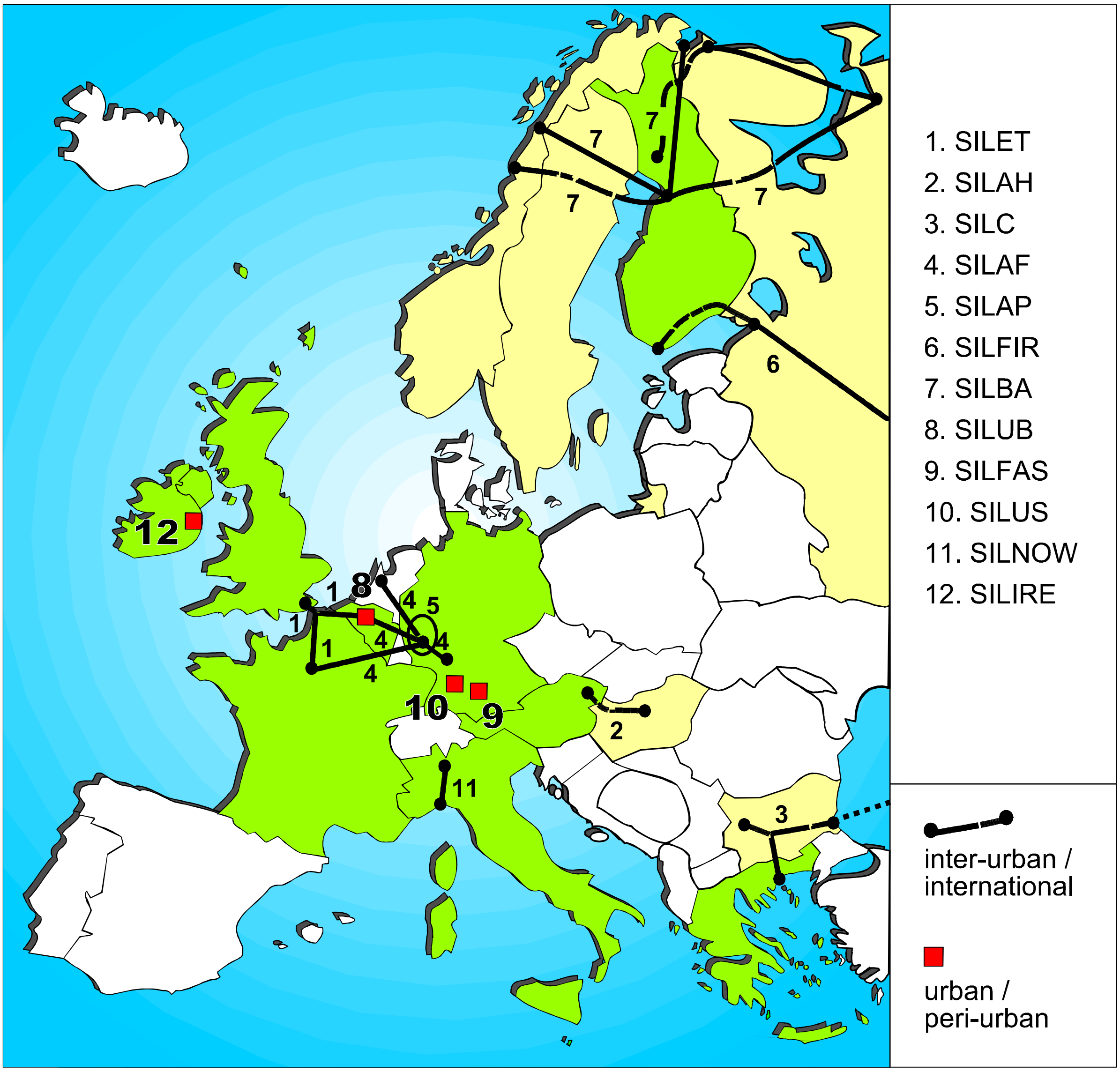

Figure 1.4: Location of the EUROSIL case studies

The EUROSIL case studies cover to a large degree the modes road, rail and air. Furthermore, inland waterway, short sea shipping and pipeline are integrated into at least one case study. The actual status of the infrastructure projects used as a basis for the EUROSIL case studies ranges from well established projects under operation to projects which are only in the planning stage. This variety allowed EUROSIL to consider on the one hand empirical (real) transport data and on the other hand, to examine forecasts and scenarios in the case studies which address IMO effects and their potential impact on Area Development.

The pool of information available from the case studies provides illustrative examples highlighting both the need for and the application of framework elements of strategic intermodal transport. Specifically, the feed-back from the case studies supports the identification of the relevant aspects of IMO orientated transport projects in connection to the resulting impacts on the potential for Area Development. Furthermore, the case studies reveal the current state of the art for modelling specific parameters in this context and provide a solid basis for developing the modelling guidelines.

Finally, the EUROSIL case studies delivered illustrative examples of good practice and even bad practice in identifying the added value and the barriers of multimodality, intermodality and interoperability enhancements and their impact on the potential of Area Development.

1.6 STRUCTURE OF THIS REPORT

This report comprises a further four Chapters.

Chapter 2 summarises the role of IMO and its place in existing policy frameworks for European transport and provides an overview on the rationale for IMO in terms of the potential added value that IMO can provide over and above uni-modal transport systems.

Chapter 3 summarises current practice in assessing the added value of IMO drawing heavily on the case studies and justifies the need for best practice guidelines to aid assessment for IMO transport interventions.

Chapter 4 provides a series of guidelines for the identification, measurement and evaluation of those features of IMO transport projects that represent the added value and in turn contribute to Area Development.

Chapter 5 provides overall conclusions on the research findings and their practical application.

2. THE ROLE OF INTERMODALITY, MULTIMODALITY AND INTEROPERABILITY (IMO)

2.1 THE POLICY FRAMEWORK

2.1.1 Relationship with EU Transport Policy

The EU's Common Transport Policy calls for the establishment of transport systems capable of providing 'sustainable mobility', so that goods and people may travel, throughout the Community, efficiently, safely, under the best possible social conditions and fully respecting the environment. The direction of transport policy development for the next five years is generally to develop the implementation of the basic policy measures already identified. The concept of 'sustainable mobility' remains at the core of the approach.

The fundamental objectives of Community transport policy make the link between the development of transport and economic activities in the regions of the Member States. In particular there is an objective of strengthening economic and social cohesion by the contribution which the development of transport infrastructure can make to reducing disparities between regions and linking island, land-locked and peripheral regions with the central regions of the Community.

Intermodality is one of the key issues in EU transport policy. Intermodal transport – including what the Commission calls 'combined transport' – is seen as a policy tool for encouraging freight to move from road to less environmentally intrusive modes, such as railways, waterways and short sea shipping. EU policies referring to intermodality incorporate inter-operability issues and, hence, the use of intermodality in this section should be taken to include interoperability.

Interoperability is seen as an important facilitator of good quality intermodal transport. The achievement of the seamless journey is dependent not only on interconnections between different modes but also on consistency in technical standards, harmonisation of regulatory frameworks (for access, operation, investment and safety) and exchange of information. It is a common theme of EU transport policy to have common standards of equipment and training to overcome the physical and institutional constraints to international transport operations.

Multimodality is also a key instrument in encouraging a move from road transport to less environmentally intrusive transport modes. There have been a number of Commission initiatives to encourage a wider choice of transport mode: the 'Citizens' Network', 'Revitalising the Community's Railways' and 'Fair and Efficient Pricing'.

Until rather recently, European transport networks tended to be developed from a national perspective, with the emphasis being placed upon individual modal networks rather than on integrated transport systems. The European Union has placed increasing emphasis on the evolution of the Trans-European and Pan-European transport networks (TEN and PEN) during the last decade. A key feature of TEN/PEN development is the emphasis on multimodal, intermodal and interoperable networks.

The IMO principles are integral to the development of the transport Trans-European Networks (TENs) and the Pan-European Corridors / TINA (Transport Infrastructure Needs Assessment) Network. The rationale is that improvements in the IMO elements lead to improved accessibility - between different regions of the Union, and between the Union and Central and Eastern Europe - which in turn, when applied in an appropriate manner, supports more spatially balanced economic development and improved social cohesion.

2.1.2 The relationship between transport infrastructure and Area Development

Transport plays a key role in efforts to reduce regional disparities in economic performance across the Union. Such disparities are closely linked to geographical location and accessibility, in the sense that the more peripheral the region and the less accessible, the lower its GDP per head is likely to be. While there are many other factors involved, it seems to be the case that, even in an age of information technology and significant advances in telecommunications, transport facilities for both passengers and freight are often critical for regional competitiveness and prosperity.

Regional support takes many forms, but in relation to the transport sector, the activities of the Cohesion Fund have been particularly relevant. Unemployment is a key consideration and the Commission recognises that it is only through support for sustainable growth and improved competitiveness in the regions that employment will be fostered and maintained.

Investment in transport alone, however, will not lead to a narrowing of regional development disparities or, indeed, necessarily contribute significantly to regional growth. For this to be the case, complementary action needs to be taken to ensure that disadvantaged regions are in a position to profit from the opportunities created by improvements in transport. In practice, the evidence suggests that carefully managed investment in transport tends to have a beneficial long-term effect on business investment and Area Development in regions, although there are wide variations in the extent to which this happens.

Overall, intermodal, multimodal and interoperable transport are at the core of developing an integrated, efficient and effective Trans-European and Pan-European transport system. The very nature of IMO projects has a potential influence on Area Development with improvements in transport efficiency leading to improvements in accessibility and, in turn, to improvements in Area Development.

2.2 POTENTIAL ADDED VALUE OF INTERMODALITY, MULTIMODALITY AND INTEROPERABILITY (IMO)

2.2.1 The interrelation between IMO and Transport System / Area Development

The decision to build or use an IMO-facility is principally based on the rationale that this facility creates an overall benefit compared to a single mode alternative. In other words, the facility must have an added value for the actors involved (e.g. user, owner, operator, transport/planning co-ordinating authority).

When discussing the added value created by IMO to the Transport System in general and to Area Development in particular, one can identify different "mechanisms" which are of varying importance. In general, one can distinguish the influence of improvements in the Transport System Performance on Area Development through the provision of improved accessibility from the influence on Area Development by the transport facility itself like e.g. in the case of a terminal creating a focal point for business location. Figure 2.1 shows how intermodality, interoperability and multimodality may contribute to that phenomenon.

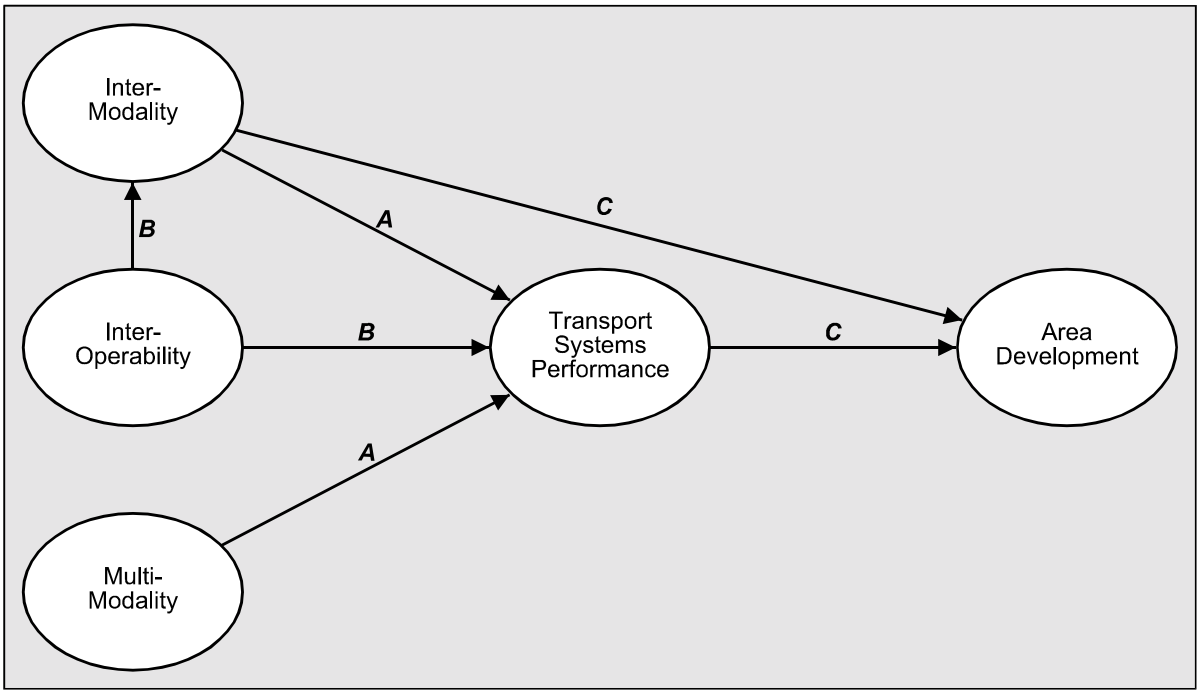

Figure 2.1: Relationship between IMO and Transport Systems Performance / Area Development

- *Intermodality* affects transport systems performance by reducing travel time or transport costs or by improving other factors like safety or convenience. Intermodal facilities like terminals can have direct impacts on Area Development e.g. by creating focal points for business location. Moreover, it is often assumed that there exists an indirect influence of IMO on Area Development "via" changes in the transport systems performance e.g. through improved accessibility.
- *Interoperability* is in many cases the prerequisite for intermodality. Interoperability influences the quality of the transport system as a whole; Its impact on Area Development exists mostly only indirectly via its contribution to intermodality or – only in a few cases (e.g. traveller information systems) – directly by improved Transport System Performance.
- *Multimodality* influences transport efficiency directly e.g. by providing more transport options and more capacity on a particular corridor. This can then influence Area Development. A direct impact from multimodality on Area Development is rather an exception.

Consequently, when describing the added value of IMO in the next chapter one may distinguish in three categories, which are also presented in figure 2.1:

- A: Added value of Multimodality and Intermodality on Transport Systems Performance

- B: Added value of Interoperability on Intermodality and Transport Systems Performance
- C: Added value of Multimodality, Intermodality and Interoperability on Area Development (both directly or "via" improved Transport Systems Performance)

The nature of such an added value can be quiet different: Often, primary objectives like changes in travel and transport times and the costs involved are considered. For example, in most of the case studies investigated in EUROSIL it is assumed that travel/transport times and transport costs are the dominant elements for modal choice in multimodal/intermodal systems. However, other impacts cannot be neglected. For example in the case of freight transport, where competition in road/rail multimodal system is limited to medium-long trip distances, improvement in accessibility to the rail system and in the reliability and safety of the relevant service offered may strongly increase the effect of reduced transport costs and/or transport times in influencing the modal choice of users. In addition, if Intermodality is considered, the conditions for complementarity between different transport modes are important for passenger transport and essential for freight transport and will therefore influence both possible added value, as well as limits and barriers. Complementarity between different transport modes is influenced by different aspects: e.g. the handling and communication chain, parking and storing space, the capacity of interconnected uni-modal infrastructures, problems at the destination, additional services or comfort (passenger) and efficient trip monitoring (freight).

2.2.2 Examples for added value of Multimodality, Intermodality and Interoperability

The EUROSIL case studies assist in highlighting how IMO can add value as summarised below.

A: Added value of Multimodality and Intermodality on the Transport System

- In general, the EUROSIL case studies show that IMO on the whole can improve the efficiency of the transport system. Specifically **Multimodality** provides independent alternative means of travel and therefore the choice of options. Whereas several factors (including travel time, trip cost, safety, reliability, comfort etc.) influence the choice to varying degrees, greater choice of options increases the overall capacity utilisation of the transport network and can lead to more balanced distribution of travel demand between modes. The effects within the transport system differ between passenger and freight transport.
- In *passenger transport*, Multimodality, causes a competitive transport service market. This competition between the modes facilitates increased efficiency. This has again an influence on the choice decisions which leads to a change in the distribution of travel demand and, in turn, changes in the physical capacities and, hence, efficiency.
- As more capacity and smoother *multimodal* traffic operations are provided for different modes of transport, the competition between modes will intensify which is further enhanced by special offers and more efficient terminal operations and services.
- Multimodality also enables market differentiation by transport suppliers and through competition can lead to customer focused and user friendly solutions.

- For *freight transport* without a significant improvement of the co-operation between the different transport modes (see Intermodality), Multimodality itself is likely to produce only a minor improvement in the overall efficiency of the Transport System.
- Although improvement in Multimodality contributes to the establishment of a competitive transport service market, the scope for balancing modal shares, consistent with EU policies can be limited, since the freight users attracted by, say, improved rail services (in terms of reduced prices and better and more reliable services) belong to a limited group of users (mainly big productive units directly connected to the rail system, or transport operators handling a specific and limited range of categories of goods).
- Besides transport time and costs, security and reliability aspects also play a role in the competition between freight transport modes. Punctuality, accuracy, time window scheduling and value added services are also of growing importance to freight transport.
- Providing more capacity via improved *multimodality* can result in the alleviation of traffic jams for road transport infrastructure. Smoother traffic operations enable faster travelling speeds and thus also contribute to more efficient operations through reduced energy consumption. In addition, in some cases impacts include a decrease in the number of accidents and thus to an increase in traffic safety.
- The development of **Intermodality** in a particular urban transport corridor provides more capacity to single modes and thus also alleviates congestion, improves traffic safety and promotes the efficiency of the entire urban transport system.
- Intermodality increases the options in *passenger transport* for travel choice by improving connections between different modal networks and provides focal points for transport interchange and integration. Therefore, the capacities of the total network increase, either by providing new transport links, or by increased utilisation of existing links, which together lead to improved efficiency. Increased competition between existing modes is facilitated by the introduction of new intermodal options.
- The case studies conclude, sometimes based on induction, sometimes based on data, that Intermodality leads to improved accessibility by optimising the passenger and freight transport system as a whole.
- In comparison with passenger transport, more significant results in terms of efficiency and of modal shares are obtained in *freight transport* by the enhancement of Intermodality. Actual achievements in this field increase the capacity of the networks through the improved connectivity between the different modal networks of the whole transport system.
- Improvements in Intermodality of a transport chain caused by additional or improved interchange points tend to improve the Multimodality on the long-distance part of the transport chain.
- Connected modal networks offer more options for travel choice, and at the same time also competition between the different modes and relevant service suppliers is enhanced, since interconnected networks allow users (freight agencies, goods' producers and distributors) to choose among several intermodal chains, within which each single freight transport operator is highly motivated to offer a better and cost-effective service.

B: Added value of Interoperability on Intermodality

- Interoperability is a prerequisite for Intermodality through its ability to facilitate harmonised interfaces with different transport systems.
- Interoperability reduces barriers between transport systems (e.g. institutional, financial, physical, technical, cultural or political barriers) and thus allows for intermodal transport chains with an acceptable level of service.
- Interoperability facilitates the integration between the modes and services (e.g. timetables, regulations) and can present a more coherent and user-friendly single transport system with common user features (e.g. ticketing, information). It facilitates the open access and the flexibility in the use of system features and enables the transferability of operating systems and procedures.
- Integration of fares/ticketing and information systems, based on both the use of new technologies and co-operation between different actors, are major features for improving interoperability.
- The use of new technologies, as well as the co-operation between the different actors, can significantly contribute to flexibility and efficiency. Due to the correlation between Interoperability and Intermodality, isolation of the different effects was seldom carried out in the case studies.

C: Added value of Multimodality, Intermodality and Interoperability on Area Development

- Added value can arise from the transport system improvements achieved through IMO either by improving the accessibility of an area or via direct impacts. Both impacts on Area Development can mainly be differentiated into economic and environmental ones.
- Whilst the environmental impacts are often not specifically considered, the emphasis on Area Development impacts related to the economic aspects, and in particular employment (job creation).
- The individual effects of IMO from area to area is far from uniform and depend strongly on the underlying regional characteristics and range of non-transport related factors (not least strength of the economy, availability of development subsidies, planning regulations etc.)
- The added value needs to be based on net effects and, here, distributional issues are important. Increased economic activity in one area might be at the expense of another area. Accessibility improvements can contribute to deliberate economy development policies aimed at reducing imbalances between local, regional and national economies.

In the following text, we summarise the potential added value of IMO on Area Development, firstly, through improved accessibility and, secondly, as direct effects.

Accessibility improvement

- An improvement in accessibility can stimulate extension of markets, offer efficiency gains and improved competitiveness of businesses leading to expansion of existing economic activities in an area and, possibly, inward investment.

- Accessibility improvements can be manifested both in reduced transport costs of locating in a given area and through increased choice and flexibility of transport.
- Accessibility improvements can increase the attractiveness of an area as a locational pole for all land-use activities. Added value here can occur through inward investment in new economic activity (taking advantage of the improved accessibility) and/or by increased land values leading to a greater intensity (including change of use) of existing buildings/sites.
- Improved access between adjoining local economies can enable specialisation of activities within each of these local economies increasing inter-dependency between them.
- Accessibility improvements can extend the choice of suppliers and the catchment area for customers and labour. This applies not just to businesses but to residents in an area, who have greater choice of employment and housing for instance.

Direct effects

- Any investment in new transport infrastructure whether it is uni-modal, multi-modal or intermodal has the potential for directly contributing to Area Development through the provision of facilities which themselves generate employment. This is particularly the case with intermodal transport which can include provision of transport hub, interchanging, transhipment facilities as part of the infrastructure of the overall scheme. Here the facility is on itself a physical development of the area generally employment directing.
- The provision of these intermodal facilities and the employment necessary to operate and maintain them might generate additional Area Development effects with ancillary and support services co-locating. The direct added value of Intermodality (and implicitly of Interoperability) on Area Development is assumed only by some of the case studies with a lack of explicit justification of the properties contributing to this added value. It is for example assumed that intermodal terminals attract possible suppliers and customers into the neighbouring areas.

The key added value from an Area Development perspective, is usually job creation. The case studies and other research indicate that the extent to which job creation is realised through improved accessibility is far from clear. In urban or peri-urban situations the case studies give some indication that positive impacts on employment and the regional/local economy can be achieved.

In a few of the EUROSIL case studies it is suggested that accessibility improvements of an integrated intermodal transport network can contribute more effectively to Area Development than investment in single mode networks. There is some evidence that strategic transport improvements make industries more competitive and extend their potential market.

Accessibility improvements can furthermore have a direct impact on the location of investments and economic activity and could be a motivating factor for international capital flows into developing regions and could therefore contribute to the economic development of these regions.

Finally, it is important to include in any list of potential added value the benefits to Area Development that might be achieved through provision of high quality IMO facilities. Here the value might be greater than both the accessibility derived benefits and the direct effects.

High quality transport infrastructure (in particular interchange) can contribute to the overall attractiveness of an area from the point of view of potential investors, stimulating thereby increased economic activity and land development.

2.3 LIMITS AND BARRIERS OF IMO

The EUROSIL case studies provided an overview of today's limits and barriers affecting the achievement of added value of Intermodality, Multimodality and Interoperability. The key statements summarising the main limits and barriers are summarised in the following text under four categories: Institutional, Organisational, Technical and Other Limits and Barriers. These statements have supported EUROSIL in the development of the guidelines.

Institutional Limits and Barriers

- Development of IMO projects, in isolation from the implementation of a regional strategy for combined transport infrastructure investments, is identified as a major constraint on the potential effectiveness of individual projects.
- The difficulty of securing private capital involvement, borrowing and credit utilisation, has constrained authorities and project promoters.
- Political differences and economic, social and cultural issues between countries are often the cause of bottlenecks in IMO, especially in Interoperability, usually manifested at border crossings.
- Competition between rail and road transport companies reinforces existing uni-modal transport patterns when intermodal chains might provide efficiency savings for users.
- Institutional structures still encourage infrastructure investment in uni-modal networks rather than in integrated intermodal networks.
- Geographical isolation can prove to be a hindrance to the achievement of added value of intermodality.
- Intermodality requires interdependencies between the different transport systems, and this could therefore reduce the competition between the modes, which leads to reduced efficiency.
- The requirements for the Interoperability could lead to an increased regulatory/co-ordination bureaucracy (e.g. need for allocation systems for costs and revenues).
- The political, technological and economic differences between countries, all affecting Interoperability, constitute an even bigger barrier for IMO in freight transport than in passenger transport. In particular, with regard to the enhancement of intermodal transport within the Pan-European Networks, a lack of an effective programme of interventions in the short-medium term for reducing/removing these barriers may cause dramatic effects on the modal split in Eastern European Countries, very likely worsening the present imbalance in comparison with Western European Countries.
- The enhancement of Intermodality through the necessary improvement of Interoperability cannot be substantially achieved through market rules only and is constrained by the lack of institutional interventions, in terms of restructuring of the composition of the goods vehicle fleets and of implementing a suitable tariff policy by public transport operators.

Organisational Limits and Barriers

- Intermodal transport is a complex issue because many actors are involved and it is important to control the information flows in an integrated way. Thus the quality of information systems represents an additional barrier to the organisational features of the new transport infrastructures. Information systems may significantly affect journey time or mode choice and lack of information flows may limit the benefits of intermodality and interoperability and the integration to the TEN and PEN both for passenger traffic or freight transport.
- Intermodal transport can be infeasible due to incompatibility concerning the capacities of different modes.
- Different actors operations at interchanges can reduce the efficiency gains (for example, different shift working).
- There are certain thresholds at which investment in new mode alternatives become viable. For example, rail based public transport access to provincial airports is constrained by the demand levels and the predominance of road based access.

Technical Limits and Barriers

- Technical and partly legislative problems arise often on border crossings - especially between the EC and the CIS and CEEC area - (vehicle size, weight regulations, wage and labour questions at customs, speed limits etc.) and consequently constrain interoperability.
- Different response levels in the adoption and diffusion of innovative technologies may lead to a lack of technical compatibility.
- Investments in infrastructure and in service differentiation and improvement, tend not to produce the expected efficiency gain, due to limitations in the proportion of demand potentially attracted by the uni-modal rail network.
- The project's size and secured financing determines the viability of a particular transport investment. These issues will in turn have an effect on the magnitude of impacts estimated for the project. In addition, different technical compatibility and other technical problems as well as legislative problems and various regulations, impose an additional constraint which may have a significant effect on the anticipated impacts, especially at international level.
- A lack of standardisation of procedures involved in the transhipment process, the use of automated transhipment facilities and the provision of customs and administrative facilities may limit intermodality and interoperability.
- Interoperability requires a harmonisation of the operating systems. The actual low standard of interconnections limits the competitive advantages caused by Intermodality. Technical problems on Interoperability may e.g. give rise to delays.

Other Limits and Barriers

- Many case studies indicate that Multimodality could lead to strong competition between the various modes. This could have positive impacts but could also lead to a lack of integration and co-operation between the modes. This increased competition could lead to a concentration of transport supply on high demand corridors.

- Intermodality requires Interoperability. This means, that the use of intermodal transport systems depends strongly on efficiently operating systems. If there exist no interfaces between the modes which provide easy access or no acceptable level of service, the users will not accept the intermodal transport offers and will therefore not use it.
- There exist many possibilities for improvements concerning Interoperability with respect e.g. to fares, ticketing and information systems. This requires the use of new technologies and willingness for co-operation of the different actors. It leads to commercial imperatives of operators, too.
- Multi-actors caused by IMO transport systems lead to cumbersome decision-making procedures.
- Induced traffic due to a new scheme or link or increased capacities can be very significant and can therefore reduce the benefit.
- Established behaviours and perceptions for certain trip purposes can limit the use of new modes.
- Intermodal transport needs efficient interchange facilities (nodes, interports, freight centres). Provision of these facilities leads to additional costs, need for land availability, increased environmental impacts and uncertainties of interchange.
- The Rail Systems in many Western European Countries are still far from providing efficient, user-tailored and interoperable services. At Pan-European level the general performance of the Rail Systems in the Eastern Countries is very poor in terms of commercial speed, level of service, maintenance of the infrastructure and available rolling stock and, hence, constrains interoperability between east and west Europe without significant investment in infrastructure and operations.

3. CAPTURING THE BENEFITS OF IMO IN THE DECISION MAKING PROCESS

EUROSIL is interested in how, on the one hand, the (classical) transport aspects are dealt with, with focus on the surplus effects of multimodality, intermodality and interoperability as well as, on the other hand, the impacts on Area Development. The findings are based mainly on the large scope of case study experiences. A short overview of these are given in the following subchapter. The current practices in assessing the impacts are then demonstrated, leading to the final subchapter, concluding the need for better practice.

3.1 THE EUROSIL CASE STUDIES

The EUROSIL approach has used as a corner stone 12 illustrative case studies (see also figures 1.3 and 1.4) representing the state of the art of "real world approaches" to IMO in different circumstances. The investigations carried out within the case studies are used to provide information on the current state of the art and to identify best practices. In order to elaborate the specific knowledge on the treatment of IMO and identification of links to Area Development, the approaches and methodologies developed in phase 1 of the project were applied within the investigations and were thus used to provide feed-back to the evaluation phase. Generalised questionnaires were used to extract specific information on methodologies, approaches and results, as well as, on the other hand, on the added value of Multimodality, Intermodality and Interoperability and the identification of Area Development aspects.

The pool of information available from the case studies provides illustrative examples highlighting both the need for and the application of framework elements of strategic intermodal transport. Specifically, the feed-back from the case studies supports the identification of the relevant aspects of IMO orientated transport projects in connection to the resulting impacts on the potential for Area Development. Furthermore, the case studies reveal the current state of the art for modelling specific parameters in this context and provide a solid basis for developing the modelling guidelines.

Each case study in EUROSIL can be regarded as an independent project, because many steps have been performed which are consistent with conventional procedures for transport planning projects (case study design, data acquisition, modelling, impact assessment, ...). In some cases, fundamental work like model development has been performed. As a sub-project, each case study had to produce a case study report, which is called 'Internal Working Paper' (IWP) (see references). Moreover, Annex 1 of the Public Deliverable 9/10 provides a short summary on each case study. The following list presents examples of key findings of the case studies to demonstrate the variety of the inputs derived from the studies.

EXAMPLES FOR KEY FINDINGS OF THE EUROSIL CASE STUDIES

SILET: Eurotunnel Corridor - UK-France-Belgium

- new and intermodal mode of travel can attract significant market share even faced with strong competition
- the competition between modes is dependent on their relative intermodality
- the regional, spatial and land use development impacts vary according to accessibility and economic development of the area

- an intermodal transport system has the potential of inducing Area Development in the immediate vicinity of terminals in both developed and lagging regions
- demand forecasts before opening do not fully materialise if the system actually operated is not to the standard expected and modelled; the impact of intermodality on attracting market share has to be taken into consideration.

SILAH: Transport Corridor Austria-Hungary

- multimodal developments and new intermodal nodes contribute to the improvement of the standard of the transport links and accessibility as well as social and economic co-operation links with the neighbouring countries
- tolled motorways appear, mainly at the domestic road users, as a sub-mode because of the deterrence effect of the tolls; new constructed tolled motorways bring, in spite of the deterrence, improvements in the traffic conditions and environment in settlements on the parallel roads and their existence has a positive effect on the location choice of companies.
- significant but not always favourable experience has been collected on private capital involvement, borrowing and credit utilisation in course of the preparation and implementation of these infrastructure developments which can be utilised in preparing other projects and liberalising or regulating certain processes

SILC: Transport Corridor to the Caspian Sea

- transport links will improve the transport system of the area, as there is a total lack of an integrated logistics chain
- new transport links will improve the production structure of the area, as most of the industrial units in the area are vertically structured while the development of advanced production concepts such as just-in-time production and just-in-time delivery are at very low levels of development for the time being
- improvement of the transport system by enhancements in interoperability, intermodality and multimodality will have positive effects on Area Development both in Greece and Bulgaria

SILFIR: Transport Corridor between Finland and Russia

- at regional level, there is a significant relocation of population and workplaces along a new high-speed rail line, as station sites with lower prices for residential and commercial facilities are most attractive to population and workplaces
- at international level, faster road connections will have a more significant impact on modal split than faster rail connections, while faster rail operations in passenger traffic will cause a relocation of population and workplaces to the metropolitan cities within the corridor
- Expensive transport investments should be directed to most critical sections of the transport chain in order to get the most benefits but on the Russian side of the corridor, physical infrastructure investments are still the most important factors for influencing Area Development

SILBA: Barents Euro-Arctic Transport Area

- development of a new border crossing station will attract freight traffic and passenger traffic and provide new opportunities to local tourism and small business enterprises as well as encourage cultural and economic activities
- new international transport infrastructure investments attract new development investments which create new jobs in the area and which are environmentally beneficial in many respects
- it is more important to create good access even by investing on uni-modal networks than to create a network of alternatives by investing on integrated intermodal networks
- the integrated intermodal networks come after the basic things are in order and they will improve the efficiency of the transport sector by creating competitive markets on the transport sector

SILNOW: Transport Corridor in the north-western Macroregion of Italy

- the actual implementation of multimodality is essential for obtaining a more rational modal split but added value on Area Development is achieved also without a substantial increase in intermodality
- further added value can be obtained through the quantitative enhancement of intermodality which is, however, strictly conditioned by the availability of effective interchange provisions
- with regard to freight traffic, concrete achievements in interoperability at nodes are the key factors for enabling the actual and cost-effective inclusion of multimodal corridors at regional level within wider intermodal transport chains at international and interregional level
- with regard to passenger traffic, the improvement of quality of services at interchange nodes, combined with

an attractive tariff policy can produce remarkable added value

SILAF: Airport and Freight Transport Intermodal Link

- expansion of the transport services at Cologne/Bonn airport will considerably extend multimodality and intermodality
- short-haul transports of 200 to 300 kilometres will still be assigned exclusively to road (trucking) and not to the road-rail-road transport chain
- only for certain good categories (and long distances!) it is worthwhile to opt for less expensive transport than air transport
- the option of fast rail connections enables especially a shift of air freight trucking (air freight transported on the road) to the railways

SILAP: Airport and Passenger Transport Intermodal Link

- improved airport accessibility provided by new railway infrastructure will influence the modal-split to the airport, but will have only minor other area or spatial benefits.
- punctual improvements at certain points (link to the airport) have only minor benefits if the underlying public transport system in the hinterland is insufficient (due to big catchment area of airports)
- at smaller airports, few riders do not justify a frequent public transport service to the airport resulting in long door-to-door travel times which together with low parking fees is a disadvantage for public transport
- trip purposes limit the use of public transport to and from airports as business travellers are not cost sensitive (taxi) and holiday makers prefer often to be taken by car by relatives, etc.

SILFAS: Fast Handling Terminal Systems

- impacts on intermodality (road-rail transhipment), interoperability (technical and operational compatibility) and multimodality (intermodal transport in competition to pure road and rail transport) as well as direct and indirect contribution to the potential for Area Development can be demonstrated
- local and regional effects can be demonstrated, such as more long-distance rail relations offered, less lorry traffic compared to a conventional system, less space required and less operational costs for the intermodal transport (terminal and rolling stock).
- Experiences gained, especially with the implementation of a new technology, imply that the external impacts outside of the transport sector have a considerable influence on the realisation of the potential.

SILBA: Transport System in the Urban Area of Brussels

- tolling system on a ring road is not appropriate but should be included in a global urban road pricing strategy aiming at inducing a shift in modal split
- most of the negative impacts of urban road pricing on the number of jobs could be compensated with the lowering of public transport fares
- if lower public transport fares are applied to commuters only, this will cause a migration of households to the periphery
- lowering of public transport fares through cross-subsidisation of public transport with the road tolling revenues will multiply the positive impact of road tolling on modal split

SILUS: Transport Corridor in the Urban Area of Stuttgart

- motorway construction has a strong impact on the long-term population distribution and a long-lasting sub-urbanisation process can be identified
- introduction of a rail rapid transit alleviates congestion on the motorway and on the TEN network which is further promoted by intermodal P+R services
- introduction of a rail rapid transit has an impact on the population distribution only in the immediate vicinity of train stops
- the changed population distribution leads to higher traffic volumes in the area

SILIRE: Transport System Improvement in Ireland

- road improvements will improve accessibility, .promote international trade and have a direct impact on the location of investment and economic activity
- improved freight handling facilities enable the use of two different modes of transport and the use of intermodal transport represents a considerable time saving compared to a uni-modal alternative
- the development of the Freight Park provides an intermodal interface between the national road network in Ireland and urban transport in Dublin, via short sea shipping link to the Trans-European network
- the organisational arrangements provided in the freight handling facility enable interoperability to exist

between road, rail and short sea shipping along the Trans-European route

A wide scope of projects

The scope of the EUROSIL case studies covers projects integrating the traditional (state of the art) techniques as well as other more sophisticated methods and models. These allow the identification of the current techniques for identifying impacts and evaluating the consequences of proposed IMO transport measures and the Area Development impacts.

The case studies of EUROSIL cover various types of measures at various levels integrating the different types and status of projects. Taking the location, the function and the spatial level as grouping criteria, they can be divided into the following groups:

by spatial level
- urban/peri-urban (SILUB, SILUS, SILFAS, SILIRE)
- interurban (SILAP, SILNOW)
- international-interurban (SILET, SILAH, SILC, SILAF, SILFIR, SILBA)

by the function of transport measure
- passenger traffic (SILAP, SILUB, SILUS,)
- freight traffic (SILAF, SILC, SILFAS)
- both passenger and freight traffic (SILET, SILAH, SILNOW, SILFIR, SILBA, SILIRE)

by spatial-operational level
- corridor case studies (SILET, SILAH, SILFIR, SILBA, SILNOW)
- interregional/infrastructural case studies (SILAF, SILC, SILAP, SILFAS)
- urban case studies (SILUB, SILUS, SILIRE)

Also, the case studies cover many of the European countries: SILET: UK, France, Belgium (also SILUB); SILAH: Austria, Hungary; SILAF, SILAP, SILFAS, SILUS: Germany; SILFIR, SILBA: Finland, Russia; SILNOW: Italy; and SILIRE: Ireland.

The number of modes involved range from two up to five. The road and rail transport modes were covered in all EUROSIL case studies. Air transport mode was considered in more than half of the cases studies (SILET, SILAH, SILAF, SILAP, SILFIR, SILBA, SILNOW). The short sea shipping was covered in five case studies (SILET, SILC, SILBA, SILNOW, SILIRE).

Most of the case studies referred to intermodal links, some cases even to intermodal networks. On the other hand, some case studies concentrated on the intermodal transfer nodes, which also often are the access points from regional networks to the TEN.

The actual status of the projects within case studies ranges from well established projects under operation up to projects which are only in the planning stage.

The variety of case studies, which is clearly seen by numerous classifications above, offered a wide aspect on IMO projects and made it possible to collect an exhaustive list of potential actors, properties and impacts referring to these actors. This multiplicity offered a broad base for the development of the evaluation method for strategic European transport projects.

3.2 CURRENT PRACTICE

In general, running through a decision making process begins with the identification of the relevant changes and interests to be considered. In EUROSIL these have been defined as properties. The defined properties have to be categorised, e.g. in form of impacts in order to ensure exhaustiveness on the one hand and to avoid double-countings on the other. As input into the actual evaluation process, each aspect obtains individual indicators which are put into a relationship to another. The applied evaluation methodologies result in a comparison of various alternatives amongst each other or against a reference case.

Due to the nature of the IMO-projects numerous parties (actors) are involved in the assessment procedure and thus the variety of interests rises. An actor within EUROSIL is in general defined as “any person or body having a strong interest in an IMO-related terminal and/or link”. The actors involved in the various evaluation problems may vary.

3.2.1 Range of Actors

Different decision makers and parties have to be considered, depending on whether the regarded project is in the development or in the operational phase. In the development phase the actors are involved in supplying the necessary inputs (e.g. land owners, capital investors) as well as in the outputs (e.g. infra/superstructure owners, designers). In the operation phase there are actors demanding the services of the terminal or link (e.g. passengers, shippers/forwarders) and on the other hand the actors involved in meeting this demand (e.g. operators, suppliers).

Definitions of the EUROSIL actors are given below:

- *Land owner:* Somebody owning the land on which the terminal and/or link is (to be) built.
- *Capital investor:* Somebody who puts money into a project.
- *Stakeholder group:* Union, ecological group, local pressure group, industrial organisation etc., appears in both phases.
- *Infra-/Superstructure owner:* Private or public body owning the terminal superstructure and sometimes also the infrastructure and/or the corresponding links.
- *Designer:* Somebody who provides plans for the new/refurbished terminal and/or the corresponding link.
- *Developer:* Somebody who uses plans to build/rebuild a terminal and/or the corresponding link.
- *Passenger:* Person making use of a network e.g. traveller on a train, vehicle driver.
- *Passenger travel agent:* Somebody who makes travel arrangements on behalf of a passenger.
- *Freight shipper:* Owner of the cargo that is to be transported.
- *Freight forwarder:* Agent representing the shipper, arranging transport (thereby usually dealing with modal operator’s agents).

- *Infra-/Superstructure operator:* Private or public body operating the terminal superstructure and/or the corresponding links.
- *Employee:* A person, directly employed by a terminal or link operator.
- *Freight agent:* Representative of the modal operators, acquiring cargo to be transported (usually from forwarders).
- *Mode operator:* Private or public body operating the mode.
- *Supplier (hardware):* Firm providing e.g. equipment, machines, parts etc.
- *Supplier (utilities):* Firm providing e.g. fuel, software, restaurant facilities, advertising etc.
- *Supplier (maintenance):* Firm providing maintenance services for terminal/link, hardware and facilities.
- *Supplier (general utilities):* Firm providing e.g. water, electricity, etc.
- *Supplier (value added services):* Firm providing logistic services (e.g. repackaging, assembling) at the terminal.
- *Policy maker (government)*

The case study investigation carried out within EUROSIL showed that the number of involved actors differs widely between case studies. Whether the case study dealt with freight or passenger traffic had a significant effect on the number of actors, the freight traffic having usually more parties involved than passenger traffic. Also, there are differences to which extent the project and thus the role of different actors were considered in different case studies. In general it can be said, that more actors were involved in IMO related projects than e.g. with uni-modal-projects. However within the EUROSIL case studies, all related to IMO, it is very hard to make any conclusions on the connection between the number of actors and degree of IMO.

In most case studies the identified actors are generally responsible parties related directly or indirectly to transport projects. The capital investors, passengers, infra-/superstructure owners and operators and mode operators are most widely represented in the identification of actors in the case studies. Also, policy makers (usually authorities) are represented often, covering the transport as well as the Area Development aspects. Agents and suppliers are represented in a minor way reflecting the difficulties of identifying properties specific to this group.

3.2.2 Identification of EUROSIL relevant properties

The importance of individual aspects in decision making and assessment varies according to:

- the interested party involved (e.g. operator, land owner, neighbourhood)
- the purpose of the transport study (e.g. transport network planning, land-use planning, investment planning, environmental assessment)
- the function of the transport measure (e.g. passenger or freight transport)
- the status of the measure (e.g. a new or an extended/refurbished terminal/link)

For each potential actor, a set of properties was defined, which were relevant to the actor's interest in the development or operation of a project giving an exhaustive list used in decision making on the location, design and operation of passenger and freight transport infrastructure as a part of European intermodal transport networks. The final list is in annex 1 of this report.

To extract those elements of the exhaustive superset likely to become of specific relevance for a certain project, a general applicable tool, called Key Indicator Selection process (KIS) was developed (see Deliverable 2). The selection process identified for a given set of actors and for a given set of exogenously identified objectives, the relevant properties for each case study. Whereas within the KIS tool, the objectives were defined independent of each other (and thus can be replaced in a liberal manner), the tool was adapted to consider the relationship between the transport related aspects (IMO) and the Area Development. Simultaneously, to avoid misunderstandings the indicators were redefined as properties and the tool was defined as the KEP (**KE**y **P**roperty selection) -method. The KEP-method is described in the guidelines chapter 4.2.

The EUROSIL properties were initially grouped into the following categories: infra- and superstructure, services and dynamics, financial/juridical aspects, employment and societal/environmental aspects. The identified properties have been treated in various manners within the case studies due to different reasons. The individual treatment is described in the following according to the above mentioned categories.

Infra and superstructure

- On the ‘accessibility’ and ‘capacity’ properties as well as ‘network and area coverage’ together with ‘throughput’ quantitative information was provided.
- ‘Accessibility’, being the central focus of EUROSIL as one or possibly the link between transport system on the one side and Area Development on the other, was clearly elaborated in all case studies.
- The correlation between ‘accessibility time’ and ‘distance’ was obvious and of these two the improvement in ‘accessibility time’ was considered more important.
- Properties like ‘geographical restrictions’, ‘extension possibilities’ and ‘terminal size’ were treated, if at all, qualitative.
- Properties, such as ‘environmental damage’, ‘equipment’ and ‘information systems’ which sometimes were initially intended to be covered in the case study investigations, were excluded in most of the case studies. The usual explanation was that there was not sufficient information available to make environmental or further operational assessment possible Also, these items were often considered not to have IMO inflicted impacts.
- Finally, with properties like ‘recycling of material’, ‘possibilities for overtaking’, and ‘topological location’, the lack of data was evident and the ‘topological location’ was generally not seen as a significant property.

Services and dynamics

- ‘Traffic volumes’, ‘expected traffic demand’, ‘network speed’ and ‘travel time’, ‘modal split’, ‘mode availability’ and ‘level of service’ have been investigated quantitatively.
- Properties, such as ‘accidents’, ‘capacity utilisation’, ‘level of safety’, ‘interchange facilities’, ‘time-tabling’ as well as ‘operational reliability’ were given less emphasis in case studies, but were treated mainly quantitatively.
- ‘Consolidation of freight’, ‘convenience’, ‘development/expansion possibilities’, ‘interchange possibilities and time’, ‘utilisation of loading units’, ‘operational regulations’, ‘throughput’ as well as ‘transport service providers per mode’ were treated qualitatively.
- Properties, such as the ‘availability and location of information systems’, ‘operating facilities by the operator and user’ as well as ‘tolling’ and ‘value added services’ were not

included in any case study. The usual explanation for the exclusion was the lack of information or the property was not relevant or it was not supposed to have IMO impacts. Also, realisation and level of e.g. value added services have several factors, whose impacts may be hard to investigate, such as institutional, societal and economic background and issues.

Financial/juridical aspects

- All cost properties, of which the costs of use, infrastructure and operations were more widely covered in case studies than the costs of accidents and maintenance together with the costs of superstructure and traffic impact, were treated quantitatively
- Further information is available on the investment properties like the duration of and return on the investment together with total investments. Also quantitative data were delivered to direct revenues and tolling (road-use pricing).
- Qualitative information was delivered in a few cases to access to capital, the duration of concessions, costs of additional/supporting services and costs of health, safety and environmental measures, juridical relationships, the value of remaining land and market demand.
- Properties not studied, include ‘competing terminals’, ‘costs of labour’, ‘financial risks’, ‘market fluctuations’, the ‘number and synergy between participants’ as well as ‘taxes and indirect revenues’. These properties obviously would have required deeper investigations and more detailed plans and decisions in operational level.
- ‘Reliability’ and ‘synergies with others with regard to investments’ as well as ‘liability’ and ‘promotion’ were mostly not regarded as relevant properties or there were no data available for the assessment. In some case studies the items have been shortly tackled by verbal description, demonstrating that e.g. ‘reliability’ can be a very important aspect within intermodal chains. However, the significance is difficult to consider using traditional methods and basing on the usually available data.

Employment

- ‘Employment impacts’ are clearly related to Area Development and were covered both quantitatively and qualitatively, while the ‘quality and size of the labour market’ was included solely as a qualitative property. ‘Social engagement’ was included, at least in a qualitative manner, in a couple of case studies.

Societal/environmental aspects

- ‘Private and public regional economic stakes’, ‘land use’ and ‘employment effects’ as well as ‘direct effects on environment’ were treated with quantitative statements.
- ‘Cohesion’ and ‘effects by authorities’, ‘energy consumption’, ‘environmental damages’ and ‘indirect effects on the environment’, ‘industrial effects’ and ‘labour regulations’ as well as ‘household density’ and ‘technical harmonization’ were covered qualitatively.
- Properties not included explicitly in any of the case studies include ‘geographical location, planning effects’ and ‘policies’, ‘stakeholder groups’, ‘limitations’ and ‘exclusions of transport’, ‘legislative, potential and pricing regulations’, ‘degree of concession’, ‘standardisation of loading units’, as well as ‘skills and training’. Some were however integrated without being able to isolate the effects.

- Within this category most widely adapted properties were 'land use' and' direct environmental effect', which were mostly considered qualitatively even though the initial intention was to cover also on quantitative assessment.

Conclusion

In general, the main reasons for not tackling a certain property were the lack of information needed or that the property was not after all found relevant for the case study. On the other hand some properties were found relevant but the research within the case studies did not permit the extent to allow the impacts of these properties to be assessed. The properties which were treated briefly – if at all – (e.g. 'telematics', 'information', 'terminal safety', 'reliability') may however be assumed to relate to an added value of IMO. Here specifically the short-comings of existing methods and tools is illustrated.

3.2.3 Assessment of impacts

Given the importance of transport as a vehicle for balancing and promoting regional development, there is a strong need for developing a formal methodology assessing the impacts of alternative transport policy initiatives. Due to the agglomeration of IMO-related projects, it becomes obvious that due to the large range of involved actors, due to the variety of project types and to the various spatial levels an additional assistance in identifying and structuring the IMO specific aspects is helpful. In the context of EUROSIL, strategic transport policies such as those related to TEN development have a wide range of impacts, which may affect directly or indirectly the various actors of a region or a country. Impact assessment should be able to accommodate these different aspects of impacts within a consistent framework.

In EUROSIL the impacts were categorised (mainly based on APAS work, see Deliverable 8) into 14 categories:

1. Cost of implementation
2. Change in operation and maintenance costs
3. Change in vehicle costs
4. Change in user costs
5. Change in non user costs
6. Change in safety
7. Change in local environmental conditions
8. Change in strategic environmental conditions
9. Change in economic development
10. Change in revenue and tax generation
11. Change in regional and spatial planning
12. Change in mobility levels
13. Technological development
14. Other strategic policy and planning impacts

A first general conclusion from the case study experiences is the fact that the aspects of evaluation / assessment regarding these impacts were treated very differently. Only some case studies applied formalised evaluation methods (Cost-Benefit Analysis, Multi-Criteria

Analysis). Some case studies confined themselves rather to a description and interpretation of revealed effects.

In many case studies, the criteria used in the evaluation/assessment process are firstly (and mainly) in the field of transport and only to a second degree in the field of Area Development. With the data and the methods available it was often not possible to cover the Area Development related impacts defined in EUROSIL in a quantitative way. Thus, it is often the case that 'accessibility' is used as the only approximation for representing effects on Area Development.

Having this focus on the "traditional" transport related criteria it is not surprising that more case studies performed a Cost-Benefit-Analysis and treated the qualitative properties qualitatively only, rather than applying a comprehensive Multi-Criteria-Approach. This has also to be seen that traditional transport projects require some kind of CBA during their planning and implementation phase.

However, the case study experiences also showed that in some cases a formalised evaluation process was not adopted and justification for investment decisions was based solely on a description of the positive impacts and the assumed benefits. These case studies stopped after determining the project impacts and presented and discussed these only in a descriptive way. On the other hand, "dis-benefits" in other regions induced by the investment seem often been neglected.

The assessment of impacts conducted in the EUROSIL case studies has been summarised in the following sections for both passenger and freight traffic, separately for urban, interurban and interurban/international studies.

Passenger traffic - Urban studies

- The assessment of impacts in urban studies with regard to passenger traffic is primarily based on a methodology specifically suited for analysing the transport impacts and the interaction between transport and land use and on a methodology which is specifically adopted for the characteristics of the urban area in study. The quantitative output of these methods has provided the basic source for the economic appraisal process. The approach includes either different transport/land use scenarios for future development or empirical before-after investigations and surveys.

Passenger traffic - Interurban studies

- The assessment of impacts in interurban studies with regard to passenger traffic includes a variety of methodologies. In some case studies, transport impacts have been assessed by using quantitative methods. These methods, based on data relevant either to the socio-economic parameters of the area involved or on the demand of the existing and planned transport networks, provide a good basis for the analysis of road and railway traffic and permits the evaluation of the supply/demand, providing also the critical areas of the network. Nevertheless, they are not sufficient in the context of providing direct information on land use impacts. Whereas a quantitative study has been carried out for transport impacts, land use impacts have been assessed on the basis of a set of qualitative factors on socio-economic, technological and policy initiatives as obtained through interviews as well as limited data collection or on the elaboration of indirect information emerging from similar projects in order to provide quantitative and/or qualitative estimations.

- Furthermore, more sophisticated operational methods for analysing the interaction between transport and land use have been used in order to gain a better understanding of the interaction between residential and employment location and the transport system. The baseline data comprises demographic and socio-economic characteristics of the regions involved as well as baseline transportation conditions. Based on these methods the expected development of population and employment induced by transport investments can be estimated and even forecasts of regional production and value added by industry and/or economic sector can be included.

Passenger traffic - Interurban/international studies

- The assessment of impacts in interurban/international studies with regard to passenger traffic includes several different types of approaches ranging from highly sophisticated, operational assessment tools, which provide better understanding of the interaction between residential and employment location and the transport system, to less sophisticated applications which were used for calculating existing and future transport productions and attractions, as accessibility changes between zones. The entire traffic and socio-economic analyses of a transport corridor/area at international level have included the forecast procedures including modal split and route choice analysis. Area Development impacts have mainly been assessed by examining the demographic and socio-economic characteristics of the regions, a set of qualitative factors on socio-economic, technological and policy initiatives as obtained through interviews as well as limited data collection and by estimations of generated secondary impacts.

Freight traffic - Urban studies

- The assessment of impacts in urban studies with regard to freight traffic stressed the necessity of constructing a clear relationship between transport demand and economical land-use patterns. The transport model applied, delivered an output which itself has formed the key input to the economic appraisal process regarding the various schemes. When the application of a model was not possible, the assessment, carried out in more a qualitative, comparing manner, relied upon data, which themselves were not of a high quality.

Freight traffic - Interurban studies

- The assessment of impacts in interurban studies with regard to freight traffic include mainly those impacts which has been based on either well established procedures or on the elaboration of indirect information emerging from similar projects. The impacts considered were both quantitative and qualitative and can be classified into the regional as well as the interregional level. Nevertheless, they are not sufficient in the context of providing direct information on the Area Development impacts.

Freight traffic - Interurban/international studies

- The assessment of impacts at interurban level with regard to freight traffic include the use of existing transport generation models which were mainly used to create instruments to represent freight traffic distribution. The task of traffic modelling is to determine traffic flows in the examined area in function of area characteristics and transport system supply to monitor quantity and modal changes of the traffic flows as a result of transport developments. This method makes it possible to quantify and evaluate the direct impacts of traffic and the changes in transport links, accessibility and transport potential of areas as a result of transport investments.

- The freight traffic impact assessment at international level is mainly based on information and assumptions about freight traffic flows, transport costs, transport and handling times for the different modes of transport. The assessment also includes the calculation of existing and future freight transport productions and attractions by zone and travel times between regions.

Conclusions on the shortcomings in the assessment of impacts

In EUROSIL the interest is in the way in which those projects that influence multimodality, intermodality and interoperability also have an impact on Area Development. However, the case studies have assessed the impacts mainly in a rather traditional way. This is why the treatment of IMO and Area Development aspects are often addressed on a general level only. The major shortcomings in the assessment of the IMO impacts on transport improvements and Area Development based on case studies are summarised below.

The IMO impacts on transport with regard to the changes in accessibility (mobility level) or changes in financial viability (costs of implementation, use, maintenance, operation) are widely covered as this is the primary focus of the majority of case studies. Despite the fact that economic development has been considered in almost every case study, the evaluation of the changes in economic development has not, however, been carried out to the planning level. Furthermore, environmental or social impacts as parts of Area Development are only slightly covered by the case studies. This leads to the conclusion that only a part of the Area Development impacts are included in the impact assessment.

It is impossible to provide exhaustive analyses covering all sectors of Area Development and regional structure by conducting quantitative analyses. The set of common impacts with special relevance to IMO usually presumes a mixture of quantitative and qualitative analyses. Moreover, the most common problems for insufficient impact assessment include the lack of data or suitability of the data. Developing guidelines will have to consider this as well as the necessity to focus on the significant primary effects. Omitting minor secondary effects, will on the other hand have to bear in mind the impact of long-term effects.

Data constraints has been demonstrated by the case studies to be a major factor limiting the scope of the assessment. These constraints arise for a number of reasons:

- Confidentiality of data, particularly where competing operators are involved
- Quality of data, particularly following institutional changes
- Empirical evidence of the link between Accessibility and Area Development is very difficult to obtain and hence many projects rely on accessibility changes as an indicator of Area Development changes.

As far as institutional issues are concerned, the identified possible IMO impacts on transport and Area Development may not be always relevant due to political, economic, social and cultural development in respective regions or countries. The institutional effects are often very hard to anticipate in quantitative or even in qualitative analyses and thus identified impacts might be misleading. Guidelines will have to consider the relevance of concordance to the approved regional/international development strategies and plans when estimating the impacts of various projects.

3.2.4 Modelling impacts

In practice, the assessment of various impacts is mostly based on models. The state-of-the-art review of modelling identified four broad groups of models which are relevant in some way to the assessment of Area Development impacts of IMO improvements. These are as follows:

1. Transport models represent the interaction between transport supply and demand. These models cannot assess Area Development impacts, but they provide the means of representing the transport impacts of IMO improvements. They also provide inputs to other models which do examine Area Development impacts. Only few transport models have been developed to deal with the transport supply and demand issues which are important for IMO. Only very few advanced transport model developments permit intermodal linkages or intermodal passenger trips to be explicitly modelled. Even fewer models are capable of dealing with the much more complex structure of intermodal freight logistics chains. However, even with the advanced models, modelling intermodality and interoperability requires substantial effort in collecting data and coding multimodal networks with intermodal linkages. At the local or sub-regional level, however, many models, particularly urban transport models, do have mechanisms which are in general use to model intermodality (for example, park-and-ride trips).

2. Accessibility models provide indicators of transport accessibility (Johansson, 1993). These models calculate indicators from which Area Development impacts of transport improvements can be inferred. In general, such models rely on information from transport models in order to derive accessibility indicators. With respect to IMO, the situation is largely determined by the little progress made in transport modelling. Modelling changes to IMO on accessibility is, in principle, no different to that for other types of transport improvements except for the specification of the spatial impedance or transport cost term, which is in most cases is the output of a transport model.

3. Regional development models are specifically geared to forecast regional economic development. There is a broad range of modelling approaches to forecast the impact of transport infrastructure investment on regional economic development (Keeble et al, 1982; Canning and Fay, 1993; Capineri, 1996). However, there is no clear agreement which approach is the most appropriate. While some approaches focus on aggregate multiplier effects of transport infrastructure investments, other models mainly address spatial redistribution effects of transport infrastructure. There is not one comprehensive approach encompassing all relevant impacts in one model. Only regional development models which rely on network-based accessibility indicators or contain their own passenger and freight transport model (such as multiregional input-output models) can forecast the impacts of improvements in intermodality and interoperability.

4. Land use-transportation models concern a broad spectrum of operational models for forecasting the spatial impacts of urban or regional transport policies (De la Barra, 1989 and 1997; Hunt and Simmons, 1993). However, most of them contain some sort of conventional intraregional transport model. Their suitability for modelling impacts of intermodality and interoperability cannot be better than that of their embedded transport models, which, as noted above, generally do not represent IMO effects very well. Few of the operational urban land-use transport models in use today take account of intermodal linkages, and most of them do not contain an urban freight transport model.

The conclusions that can be drawn from the state-of-the-art of modelling multimodality, intermodality, interoperability, accessibility and area impacts of transport infrastructure are not altogether encouraging regarding to IMO. With some generalisation it can be said that the majority of models used to forecast the impacts of transport infrastructure improvements are poorly suited to model the effects of improvements in intermodality and interoperability. In each category of models reviewed there are only a few innovative, pioneering modelling approaches capable of dealing with the added complexity of intermodality and interoperability.

Shortcomings within the modelling used in EUROSIL

Models are laborious tools and their implementation requires plenty of resources and data. At their best, models produce educated estimates for expert analysis and impact assessment rather than exclusively reliable information about the impacts. Therefore, one may not only focus on examining quantitative impacts, especially, as the description of intermodality has turned out to be complicated and insufficient in some models. This has been well revealed in case studies which have included models at various level of sophistication – some case studies have not practically used any models.

Examination of the modelling approaches used in the 12 EUROSIL case studies revealed that only a minority of the modelling approaches adopted explicitly dealt with representing Area Development IMO effects in a detailed manner. Most of the models employed in the case studies do not explicitly address some of the fundamental requirements of assessing the Area Development impacts of multimodality let alone intermodality and interoperability. Moreover, many of the transport models being used in the case studies do not have the full technical specification to address transport system impacts of intermodality and interoperability.

Certain other models do, however, have mechanisms that will permit the transport impacts of improvements to multimodality, intermodality and interoperability to be assessed and, through the calculation of accessibility indices, allow some inferences on Area Development impacts to be drawn.

3.3 THE NEED FOR BETTER PRACTICE

Whilst many of the appraisal procedures for informing decisions on transport investments are well established the extent to which intermodal, multimodal and interoperable transport interventions contribute to Area Development is less well understood and consequently decision-making tools are less well developed.

Therefore, EUROSIL concludes that there is a need for better practice in assessing the added value of the impacts of IMO and its influence on Area Development. This need for better practice is founded on a combination of

- the increasing emphasis placed on IMO in the evolution of the TEN and PEN and the contribution of transport to economic development and social inclusion;
- evidence, that there is real added value associated with IMO in terms of improvements in the quality of transport and accessibility;
- the shortfalls in current practice in capturing this added value in the assessment and therefore decision-making process.

The European Union has placed increasing emphasis on the evolution of the Trans-European and Pan-European transport networks (TEN and PEN) during the last decade (European Communities, 1996; European Commission 1997a; Spiekermann and Wegener, 1994, 1996 and 1998). A key feature of TEN/PEN development is the emphasis on multimodal, intermodal and interoperable networks. Apart from the broader sustainable mobility objectives another important objective of these interventions is to achieve improved accessibility which, when applied in an appropriate manner, supports Area Development leading towards a more spatially balanced economic development and improved social cohesion. This aspect is particularly important for peripheral areas in Western Europe as well as for the countries of Eastern Europe in the light of the future accession to the Community.

The Commission's transport policies are aimed at improving interoperability in conjunction with the development of intermodal and multimodal door-to-door transport, and thereby seek to promote a greater use of environmentally friendly modes of transport with spare capacity. By improving the potential for these modes and by offering effective alternatives to single-mode road journeys intermodality supported by interoperability will help to overcome congested road networks as well as improve the efficiency in the operation of the transport system as a whole.

Whilst IMO is encouraged in policy terms, ultimately its value to transport efficiency and Area Development is dependent on rigorous examination to ensure the potential added value is likely to be delivered. The investigations of the EUROSIL case studies work revealed, that this added value exists. Examples are given in Chapter 2 namely for the potential added value of

- Multimodality and Intermodality on Transport Systems Performance,
- Interoperability on Intermodality and Transport Systems Performance and
- Multimodality, Intermodality and Interoperability on Area Development (both directly or "via" improved Transport System Performance).

However, the EUROSIL case studies also showed, that even those projects aimed at investigating IMO schemes need comprehensive guidance already at an initial stage concerning all relevant aspects (like properties and impacts to be covered, actors to be considered or measurement / modelling peculiarities arising) for covering the impacts of IMO on Area Development. This applies in particular to Area Development effects given greater uncertainty over these materialising and the difficulties of identifying them.

Moreover, the work of EUROSIL also revealed that there is still a number of obstacles which prevent the extensive use of intermodal transport. These include the lack of a coherent network of modes and interconnections, the lack of technical interoperability between and within modes, a variety of regulations and standards for transport means, data-interchange and procedures. There are uneven levels of performance and service quality between modes, different levels of liability and a lack of information about intermodal services.

In summary, the state of the art shows that whilst IMO and Area Development benefits are often claimed, these are usually not sufficiently defined (including impacts by different actors etc), measured or evaluated. For example, the examination of the modelling approaches used in the 12 EUROSIL case studies revealed that only a minority of the modelling approaches adopted explicitly dealt with representing Area Development IMO effects in a detailed manner. Most of the models employed in the case studies do not explicitly address some of the fundamental requirements of assessing the Area Development impacts of multimodality, let alone intermodality and interoperability. Moreover, many of the transport models being used in the case studies do not have the full technical specification to address transport system impacts of intermodality and interoperability.

Under these premises, it is important to ensure that the potential benefits of intermodal transport facilities are

- identified,
- measured and
- captured in the evaluation process

ideally on a consistent basis.

Hence, there is a **strong need for guidelines on how to do this**, in order to assist a decision maker in assessing intermodality, multimodality and interoperability and the influences on Area Development in a comprehensive way. In response to that need, EUROSIL provides a series of guidelines and recommendations.

4. EUROSIL Guidelines

4.1 THE OVERALL FRAMEWORK

Whilst many of the appraisal procedures for informing decisions on transport investments are well established, the extent to which intermodal, multimodal and interoperable transport interventions contribute to Area Development is less well understood and consequently decision-making tools are less well developed. The overall aim of EUROSIL, therefore, is to elaborate a modelling and evaluation framework to support decision making processes with respect to impacts of multimodality, intermodality and interoperability on Area Development in the context of the Trans-European and Pan-European Networks.

Although the EUROSIL framework is specifically tailored towards the requirements and the characteristics of IMO and Area Development, the entire approach must fit into the systematic of a general evaluation process as presented in figure 4.1. The figure specifically demonstrates where EUROSIL offers support for interested parties (e.g. decision makers, evaluators, operators, ...) within this general process.

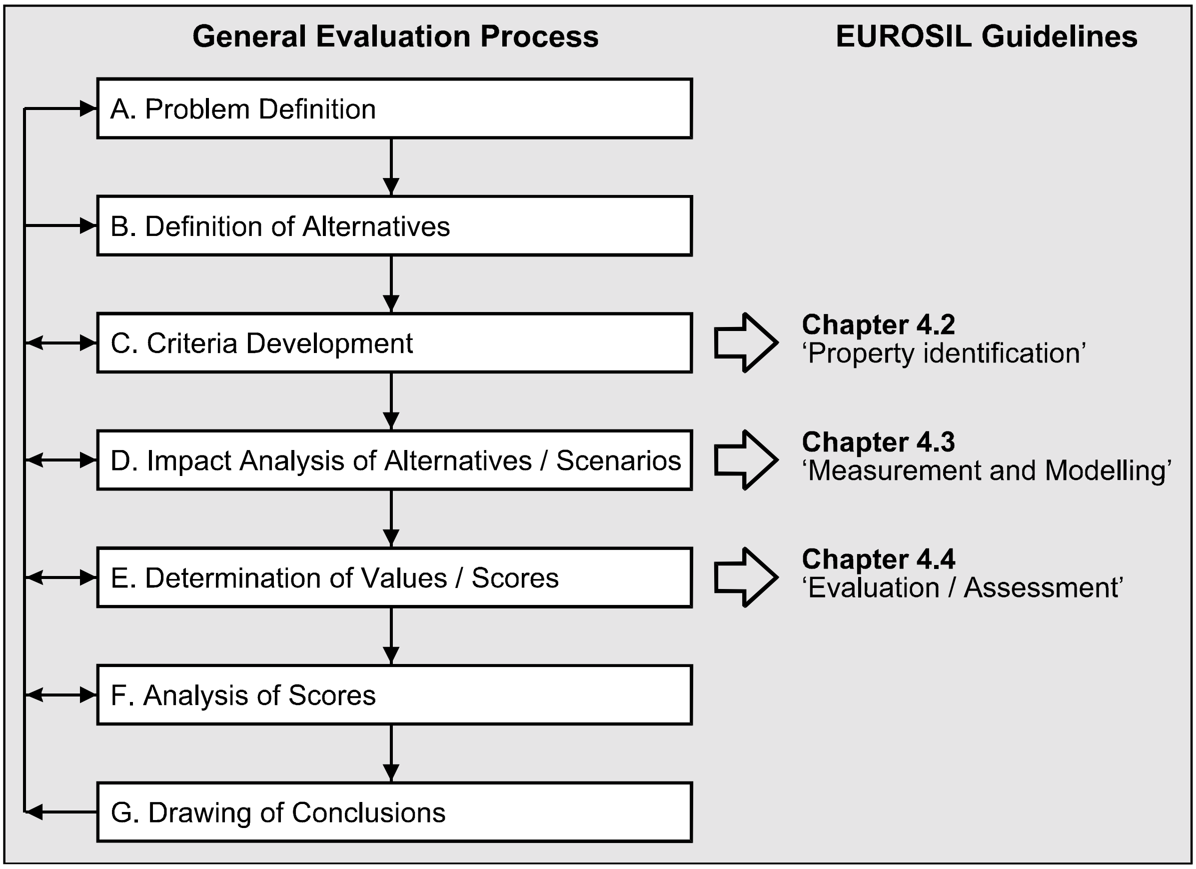

Figure 4.1: General Structure of an Evaluation Process and the specific EUROSIL support

An evaluation process in principle starts with a definition of what has to be evaluated by defining the problem and setting the goal of evaluation (Nijkamp, 1981) (step A in figure 4.1). An integral part of this initial step is a state analysis, e.g. including an appraisal of the current transport demand and levels of service (supply), land-use patterns, financial, regulatory and funding frameworks. In case of IMO the problem and goal description might contain the identification of obstacles to intermodal transport as well as the objectives of transport investments and policies for the removal of these obstacles. Moreover, some fundamental prerequisites for the evaluation process must be determined such as the time horizon, for which the costs and the benefits have to be revealed, and the spatial dimension of the study area. The latter is important to cover all positive and negative aspects of the project under consideration. Taking employment effects of an intermodal freight centre as an example, it is not only necessary to consider the number of new jobs created in the centre but also the losses in neighbouring regions e.g. by the movement of firms to the new location.

Next step (B) is the identification of a range of alternative scenarios, which consist of the likely solutions to the problem. Scenarios enable alternative views of the future to be considered in the evaluation process enabling indicators to be measured and compared under different assumptions about future events. Thus, the technique of using different scenarios and performing sensitivity tests relating to the possible range of single impacts are widely used in the real world applications.

Next step (C) is the definition of the problem related evaluation criteria. As this and the consecutive steps have been identified to be of special importance in the field of IMO and Area Development, the EUROSIL framework was developed to provide specific guidance (see below and following chapters). For the selected evaluation criteria the impacts have to be revealed for each alternative/scenario under investigation (step D). Measuring / Modelling and estimation techniques – possibly tailored to the requirements of intermodal transport – must be applied.

On the basis of the investigations of step D, in step E the evaluation/assessment procedure has to be performed by assigning "scores" to the impacts. This is usually done by transforming the criteria related impacts into a one-dimensional system e.g. by using the money values or score points. These scores have to be analysed (step F) by simply comparing the alternatives for each criterion and by listing for each criterion the strong or weak alternatives. In the last step (G) conclusions have to be drawn and recommendations have to be prepared for the decision-maker based on the results of the previous steps.

The general evaluation process outlined in Figure 4.1 contains many feedback loops in order to adjust the process on the basis of intermediate results and emerging requirements.

It is very important to design or use evaluation processes that try to assess the pros and cons of a certain choice alternative for separate groups or regions. It is important also that these processes have a cyclic nature. The term „cyclic nature“ implies the possible adaptations of elements of the evaluation due to continuous consultations between the various parties involved in the planning process at hand. The degree of complexity of an evaluation process depends among others on the evaluation problem treated, the time and knowledge available and the organisational context.

In order to support the structuring of the EUROSIL modelling and evaluation framework the results of a set of illustrative case studies have been used by providing both input for the applied aspects of the system under construction as well as test-bed cases for application in the overall framework. The experience from these "real world cases" showed that there are three general areas which need explicit guidance by using that framework in order to cover the IMO and Area Development specifics:

- the **identification** of the *relevant* properties and impacts to be investigated,
- the **measurement / modelling** of the dynamics of the identified criteria due to IMO and
- the **assessment / evaluation** of the scheme under investigation.

Especially the first and the second step need particular assistance by EUROSIL due to the facts that intermodality is compared to traditional uni-modal transport projects a relatively new and seldom applied approach and that the complexity and the interdependence between the various influences increases with the growing number of modes and actors involved in intermodal projects. Consequently, the EUROSIL modelling and evaluation framework comprises three major stages as these can be seen in Figure 4.2, namely

- **STAGE I: The Evaluation Criteria Development Process (ECDP):** Within this step the person in charge for the assessment (e.g. the decision maker or his staff) must determine the properties, impacts and indicators he needs to use for the project appraisal. The choice of the evaluation criteria depends amongst others on the project objectives, the project outline and the actors involved. Therefore, the entire procedure has - as indicated in the figure by the dotted line - to be specific for the actors and objectives under investigation. However, as a matter of fact in practice, the choice of the evaluation criteria depends also on the available methods for modelling/measuring and evaluating as well as on the personal preferences of the evaluator. As the selection of the suitable evaluation criteria has been identified as the most IMO- and Area Development-specific process within the framework a tool called KEP (Key Property selection) was established for assisting the evaluator (see section 4.2 for details).

  ↳ EUROSIL offers assistance:

  exhaustive lists of properties and potential actors to ensure that the relevant aspects of IMO and Area Development are covered

  potential indicators and impacts to support the treatment of the identified criteria in the evaluation process

- **STAGE II: The Modelling/Measuring/Estimating the Dynamics (MMED):** For each selected criterion the probable changes caused by the project must be determined. Here again the IMO and Area Development specific aspects have to be taken into account. The changes can be measured, modelled or perhaps only estimated depending on many prerequisites like the nature of the criteria itself, the data availability, the model availability, the time frame (ex-ante/ex-post) etc. Often, different scenarios are taken into account to cover the broad range of possible future developments (see section 4.3 for details).

  ↳ EUROSIL offers assistance:

  overview of potential models treating IMO and Area Development and discussion of their capabilities

  guidance of how to consider IMO and Area Development aspects in the modelling process

- **STAGE III: The Evaluation / Assessment Process (EAP):** In this stage, the changes in criteria must be evaluated, which means that an evaluation method (e.g. Cost-Benefit-

Analysis or Multi-Criteria-Analysis) must be performed. This requires – depending on the method – a monetarisation of the criteria or the assignment of values and weights per criterion and a concluding judgement (see section 4.4 for details).

➭ EUROSIL offers assistance:

- comparison of evaluation methods and discussion of their suitability to cover IMO and Area Development aspects
- guidance where to be aware of valuing and weighting specifics of IMO and Area Development aspects in the evaluation process

The figure 4.2 serves as backbone for an in-depth description of each of the three stages in the following sections 4.2 - 4.4. These sections provide a set of reliable and comprehensive **guidelines** to assist an decision maker or evaluator in the identification and assessment of the potential Area Development impacts achievable through improved accessibility arising from intermodal, multimodal and interoperable transport projects.

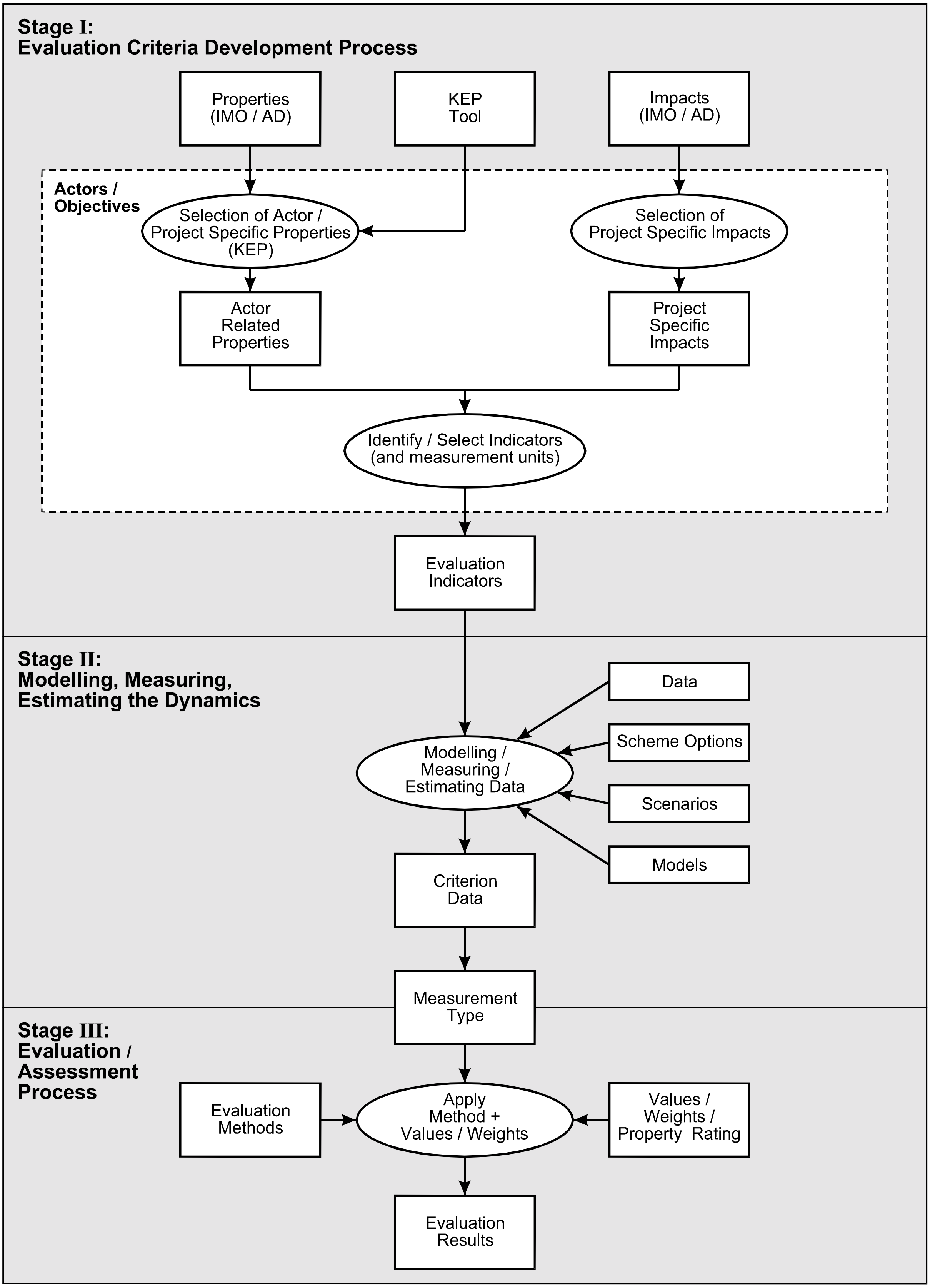

Figure 4.2: The EUROSIL Modelling and Evaluation Framework

4.2 GUIDELINES ON THE IDENTIFICATION OF PROPERTIES/INDICATORS/IMPACTS (STAGE I)

4.2.1 Overall requirement

One of the principal tasks in the conventional analytical processes, such as cost benefit analysis (CBA) or multi-criteria analysis (MCA), is the identification and disaggregation of the specific impacts on the land use development of particular areas, resulting from changes in the transport system. EUROSIL is especially concerned with ensuring that transport effects, in particular those relating to changes in Intermodality, Multimodality and Interoperability, are properly accounted and incorporated in the evaluation framework.

The **Evaluation Criteria Development Process** – Stage I of the Evaluation Framework – combines four steps:

- Definition of the full range **actors** with an interest in the project and the **objectives** underpinning the project,
- Identification of a set of **properties**, related to the project specific interests and objectives,
- Identification of **impacts** producing the necessary or desired indicators to be considered in the subsequent evaluation process,
- Definition of appropriate **indicators** in terms of precise measurement units.

Considering the relationship of the three transport system related key EUROSIL IMO objectives (Multimodality, Intermodality and Interoperability) on the fourth objective of "Area Development" (AD), the steps mentioned above can be subdivided into the following tasks:

- identify the properties which are influenced by changes in IMO as a summary of all involved actors
- quantify the impacts on the transport system due to a change of IMO using appropriate indicators for the identified properties
- identify the properties of Area Development which are subject to alteration due to changes in the transport system;
- quantify the impacts of the transport system on the area and its potential Area Development using appropriate indicators for the identified properties.

EUROSIL defines the four key elements necessary for evaluation purposes as defined in Fig. 4.3 below (see also section 3.2.1 'Range of actors')

Element	Definition	Example
Actor	Person or body having a strong interest in a terminal and/or link	*Passengers*
Property	Characteristic describing a situation	*Level of Service*
Indicator	Measure for one or more properties	*Frequency of Service*
Impact	Change of at least one property in a certain situation. Measured as the difference of one or several indicators	*Improved Accessibility*

Figure 4.3: Key elements of the EUROSIL evaluation process

To assist the identification process of the IMO/AD relevant evaluation indicators within the stage I of the figure 4.2, EUROSIL has developed the so called **KE**y **P**roperty Identification (KEP) tool.

Step 1: Actors

The purpose of the KEP User Guide is to provide evaluators and decision-makers with a tool that can facilitate the analysis of the specific impacts to the development potential of an area that result from changes to key transport related properties. These key changes are defined as those affecting intermodality, multimodality and interoperability activities and the user guide will highlight their potential influence on Area Development in order to help ensure that all IMO-specific considerations are taken into account by planners, developers and public authorities.

Due to the large variety of potential projects, their different scales and the numerous potential impacts, a systematic approach is necessary to ensure coverage of all relevant items associated with the three EUROSIL IMO objectives of intermodality, multimodality and interoperability and the Area Development. An actor-orientated method was chosen, as the importance of individual impacts in decision making and assessment varies according to:

- the interested party involved (e.g. operator, land owner, residents)
- the purpose of the transport study (e.g. transport network planning, land-use planning, investment planning, environmental assessment)
- the function of the transport measure (e.g. whether passenger or freight transport)
- the status of the measure (e.g. a new or an extended/refurbished terminal/link)

An exhaustive list of EUROSIL relevant actors is provided in Fig. 4.4 below.

Development	**Operations**	
Input	**Supply (Direct)**	**Demand**
Land Owners	Infra-/Superstructure operators	Passengers
Capital Investors	Employees	Passenger Travel Agents
Stakeholders (development)	Freight Agents	Freight Shippers
	Mode Operators	Freight Forwarders
		Stakeholders (operations)
Output	**Supply (Indirect)**	
Infra-/Superstructure owners	Suppliers - hardware	
Designers	Suppliers - utilities	
Developers	Suppliers - maintenance	
	Suppliers - general utilities	
	Suppliers - value added services	

Figure 4.4: Actors with an interest in IMO changes within the transport system

As the KEP approach has been developed to aid the evaluation of transport projects and has been designed to be an actor led process, the KEP guidelines can be used either by a single actor to identify their own benefits or for a group of actors to highlight more global benefits.

Step 2: Properties

EUROSIL has established a superset of approximately 125 properties, independent from impacts. This list covers all relevant decision-related aspects of the above mentioned actors. The list appears in the **Annex 1** of this report. This list has also been incorporated into an interface called “TRANSLATOR” to the evaluation tool “DEFINITE”. (Please refer to the public Deliverable 9/10 of EUROSIL for more details on this. The TRANSLATOR software has been developed in the context of the EUROSIL project and thus held a EUROSIL patent submitted to EC). As the list is a result of a top down approach it might well be the case that for certain analyses only a small number of properties will be relevant. However, the comprehensive coverage of all possible relevant properties ensures that each individual actor (decision maker, policy maker etc.) is confronted with all possible additional relevant aspects of IMO-impacts on Area Development.

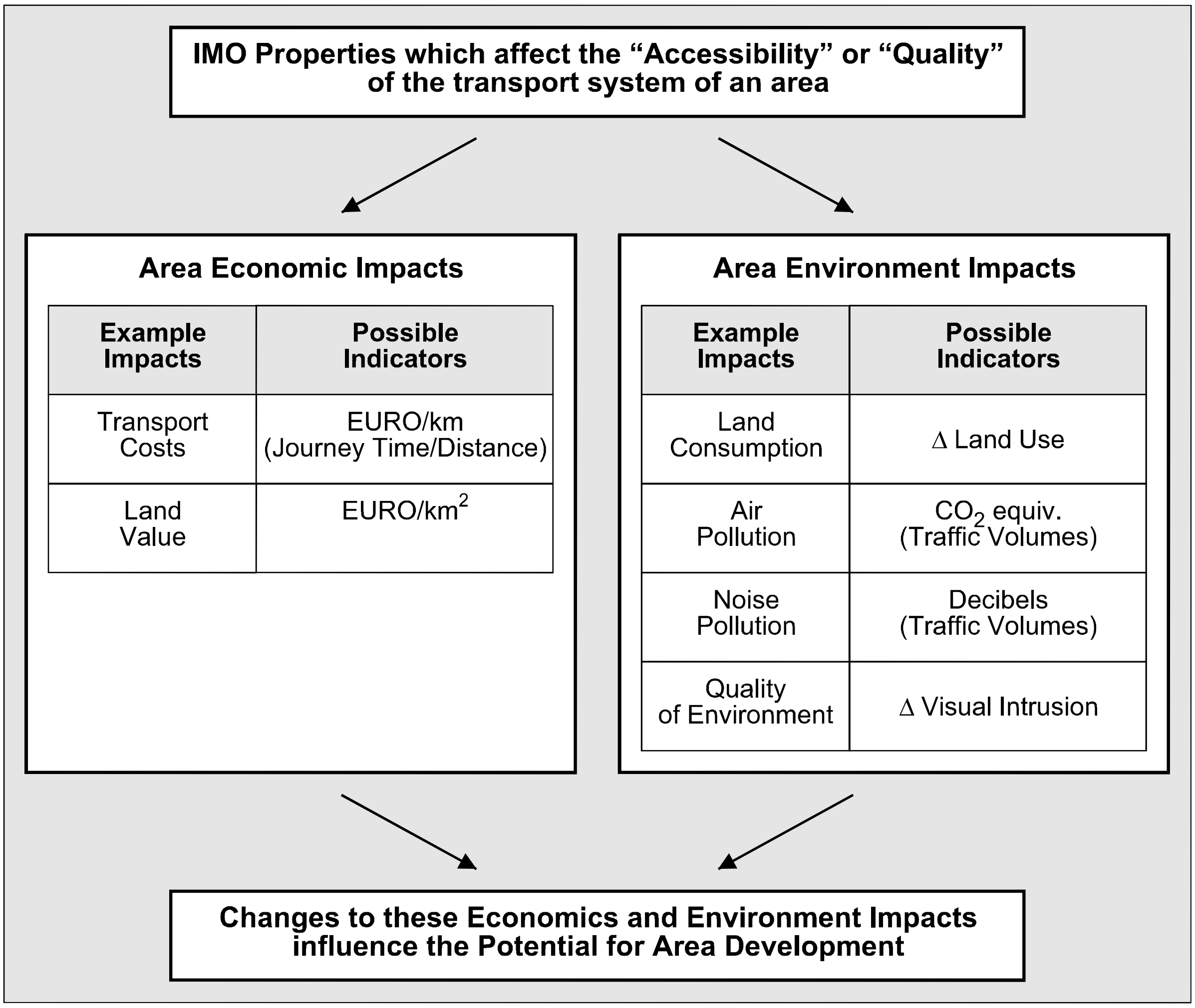

Figure 4.5: Overview of the relationship between IMO related properties and the potential for Area Development

In order to ensure that only those elements of the list which are IMO-related transport properties and which can influence the potential for Area Development are included in the KEP analysis, the superset of EUROSIL properties underwent a filtration process. This filtration process has confirmed that all initial "properties" can be allocated too either economic or environmental Area Development impacts and enabled them to be properly classified as such. The filtration has also confirmed that two of the original EUROSIL properties "Accessibility" and "Quality" represent the key factors in linking the main set of IMO related properties with the economic and environmental impacts that can influence the potential for Area Development, as demonstrated in Figure 4.5.

For a detailed discussion of those properties which have been excluded from KEP using the filtration process, users of the KEP approach should consult the final public Deliverable 9/10 of EUROSIL.

The list of IMO related properties finally considered in the KEP analysis appears in **Annex 2**.

Step 3 and 4: Impacts and indicators

To assist the impact selection and the allocation of properties to ensure full coverage and simultaneously avoidance of double countings, the Annexes group the properties into seven categories: ***Safety; Network Capacity; Area Development related Capacity; Actors; Added Value; Telematics*** and ***Finance.***

Each property is specifically linked by means of a property numbering system to other similar properties. This serves to alert users of the KEP methodology to the danger of double counting if the impact of two or more similar properties are being examined. The Table furthermore shows which of the two key properties "Accessibility" (A) or "Quality" (Q) are altered by each IMO related property and also indicates the possible economic and environmental impacts (Y) of changes to a particular property. (It should be stressed, however, that this latter information is for general guidance only, since the exact impacts will vary from case to case).

Additional comments

It is intended that these guidelines will also benefit planners and decision-makers aiming to understand and the IMO-related transport conditions that are most likely to influence Area Development to allow to create the respective IMO-related transport conditions that are most likely to encourage Area Development in the desired manner. To allow this it is prerequisite that users of the KEP analytical process should be aware of the strong and weak points of this approach. In particular, users, must be aware that this methodology only examines the **"primary impacts",** such as transport costs and quality of the environment, which have the potential to influence Area Development. These "primary" impacts do not themselves automatically lead to Area Development due to the strong influence of other key factors (such as the availability of government subsidies etc) which make it difficult to establish a direct link between IMO property changes and both "traditional" Area Development impacts (industrial and employment effects) and other subsequent impacts on government planning and policy, e.g.:

- Employment effects, e.g. direct and indirect changes of number of created jobs (e.g. part-time, full-time, male/female, age structure),

- Industrial effects on nearby primary, secondary, tertiary and quaternary sectors e.g. change of industrial job density, number and types of businesses, technological development, economic growth
- Local, regional national planning processes
- Land use and transport policies (local, regional, national and EU)

4.2.2 Example Application of the KEP Guidelines (Public Transport)

The following example of an application of the KEP Guidelines is provided for demonstration purposes and is based on the analysis of city centre public transport interchange that has been rebuilt into a more modern transport facility. The example details are presented in *italics* (with comments in brackets).

1) *Identify actor and objectives to be analysed:*

ACTOR: PASSENGERS

(Other possible actors would be: Bus Operators; Retailers; Developers; Local Authorities: Transport Authorities; Staff and Local Residents and Businesses.)

Actors can be analysed using the KEP methodology either individually or collectively as required by the KEP user, although if more than one actor is analysed then care must be taken to avoid double counting changes to properties and impacts that are common to two or more different actors.

OBJECTIVES: The objectives of the passengers are: easy access to the city centre, convenient interchanges between other modes and services; good information provision; a high level of passenger comfort; good ancillary facilities; and an environment that is attractive and safe.

Other actors will of course have different objectives e.g. the operator of the interchange will be interested in properties that influence maintenance costs and revenue, so it is important that objectives are identified separately for each actor. The objectives of other actors will need to be considered together with the broader policy objectives of Public Authorities; Land Owners and Developers in terms of encouraging Area Development.

2) Identify those IMO properties which impact on Area Development that are important to the actor (PASSENGERS) in this analysis:

The IMO related properties in Fig. 4.7 below represent those which could possibly be of importance to "Passengers" and could also potentially have an influence on Area Development. Obviously not all of these may be appropriate every passenger interchange facility but the intention is to present a list of possible permutations that might be applicable to this example.

P no.	Property	Explanation	Property Links	Area Accessibility / Quality	“Area Development Potential” Impacts				
					Economic		Environmental		
					Transport Costs	Land Values	Pollution (Air /Noise)	Land Consumption	Quality
SAFETY									
46	Safety (Terminal)	Maintenance of Safe Terminal Environments	45 71	Q	Y				Y
NETWORK CAPACITY									
27	Interchange Facilities	Terminal for Interchange between Services	14 15 18 22 28 29 68	AQ	Y				Y
34	Mode split of a journey	No. of modes used per journey	3 15 18 33 35	A	Y		Y		
35	Modes Available	Number of modes	3 18 33 34	A	Y		Y	Y	
14	Terminal size	Terminal Size/Capacity	3 15 18 27	A	Y			Y	
29	Interchange time	Maximum transfer times	3 18 27 28 62	A	Y				
62	Trip, duration of	Total duration of trip	3 18 54 61 63	A	Y	Y	Y		
63	Trip, length of	Total length of trip (distance)	3 18 62	A	Y		Y	Y	
15 53	Throughput	Volume of freight/ pass. per time unit	Most Net. Capacity	A	Y		Y		
54	Timetabling	Service ODs and frequency	3 15 18 30	AQ	Y				Y
59	Transport service providers	Number of operators	3 18 35 68	A	Y				
AREA DEVELOPMENT RELATED CAPACITY									
112	Geographical location (relative)	e.g. urban/rural areas, transport networks	6 9 10 16 23 113	A		Y			Y
ACTORS									
92	Participants, synergy between	Level of co-operation between companies	19 20 68 103	Q	Y				
ADDED VALUE									
21	Convenience (Comfort)	Comfort of the terminal for the user	30 37	Q	Y				Y
30	Level of service	(e.g. speed/travel time, frequency, comfort)	21 37	Q	Y				Y
37	Operating facilities (user)	(e.g. ticket offices, shops, waiting rooms)	21 30	AQ	Y				Y
43	Reliability (oper.)	Punctuality of operations	30	Q	Y				
125	Technical harmonisation	infrastructure, units, vehicles, fares, document	3 8 15 18 20 30 102 126	A	Y				
64	Value added services	Measures to improve the terminals/links/services	21 37	Q					Y
TELEMATICS									
25	Information system (real time)	Variable message signs, vehicle tracking	8 13 21 37 52 64	AQ	Y		Y		Y
52	Telematics (services)	Added value transport information	8 13 21 25 30 37 64 98	AQ	Y				Y

Figure 4.6: Example identification of properties relevant to a particular actor (Passengers) in a given situation (new interchange facilities)

It is apparent that with so many variables it is likely that not all eventualities have been covered by the filtration process and users of the KEP approach should use the identified properties and related impacts as a guide and use their judgement to determine whether any additional impacts not identified do in fact occur. If users wish to conduct a more complete analysis including non-IMO property impacts then they can refer to the complete list properties identified by EUROSIL which also appears in appears Annex 1 and the background to the KEP approach which is described in the public Deliverable 9/10.

Special attention should be paid to the definitions of individual properties (which appear in abbreviated form in the "Explanations" columns to ensure that users are in fact measuring what they intend to analyse and not something slightly. or indeed totally, different.

In cases where users have already identified IMO properties excluded from KEP by the filtration process, then suitable alternative properties should be identified and used instead. For example "Accidents" could be used in place of "Cost of Accidents" since the latter forms part of the economic impact "transport costs". Indeed it can be seen that a change "Accidents (frequency and seriousness)" property can have as an impact a change to the "Cost of Accidents" and to overall "Transport Costs".

3) ***Identify the impacts of each identified IMO property in terms of Area Development indicators (Cross-check other properties in the same category and in particular any "Linked Properties" to ensure that similar properties are not double counted)***

Using the "Network Capacity" category properties as an example *(although users of the KEP methodology will of course have to examine all relevant properties),* the anticipated impact of the identified properties in terms of AD impacts is indicated in the "AD Impacts" columns for economic and environmental impacts which should be measured and/or quantified for each example as appropriate. In this case changes to the "Interchange Facilities" properties is obviously of importance to the actor (PASSENGERS) and these can impact on Area Development by improving both the "Accessibility" (A) of the area and the "Quality"(Q) of transport system thereby effecting the "Environmental Impact" of "Quality of the Environment" which is improved. Depending on the precise nature of the change in property the "Economic Impact" of "Transport Costs" could also be affected for this actor (if for example the improvement in terminal facilities results in operators being charged more to use the facilities and this cost increase is passed on to passengers by way of higher fares).

Other "Network Capacity" properties such as "Modes Available" or "Modal Split" may in some instances be of importance to "PASSENGERS" and affect Area Development if the changes in terminal facilities were to introduce a new mode such as light rail to an existing bus terminal or if the improvements to the terminal are such that they result in an increase in public transport patronage.

(It will of course be for each user of the KEP approach to determine whether a particular IMO property is important to a particular actor and whether this property does in fact impact on Area Development in the particular case under examination).

Within the category it can be seen that there are obvious links between some properties (e.g. "Interchange facilities" (27) and "terminal size" (14) and also between "modal split of a journey" (34) and "modes available" (35). Referring to the numbers in the "Property Links" column also highlights possible links to properties outside the "Network Capacity" category such as that between "timetabling" (54) and the "Added Value" category property "level of service" (30). In each of these case care must be taken to avoid the danger of double counting what is the same impact described by two or more different properties. Although possible links between properties have been highlighted in the table it must be remembered that these are only significant if the same effect is being measured by both properties. In the example of “timetabling” the linked property “level of service” must only be excluded from further analysis to avoid the double counting that would arise if this property were also representing a timetabling related change. The “level of service” property could also be representing “vehicle comfort” or “number of staff” in which case the double counting issue does not arise with the “timetabling” property (although in this case the “level of service” property may now of course be linked to a different property) .

(It is again the responsibility of the KEP user to undertake this checking of links that may lead to double counting and to take appropriate action.)

Once the effects of all relevant properties on the Area Development impacts has been completed the results provide a useful indication of how the IMO related aspects of a particular measure that are important to a particular actor are linked to improving the potential for Area Development. These can be compared with the objectives of both the particular actor and the broader policy objectives related to the promotion of Area Development as desired by the user of the KEP approach.

4.3 GUIDELINES ON MEASURING/MODELLING (STAGE II)

4.3.1 Overall Requirements

The objective of the overall evaluation process in transport is to:

- enable the true effects of transport policy and infrastructure investments already implemented to be as fully understood as possible (ex-post evaluation); and
- assist transport policy and investment decision-making (ex-ante evaluation).

The second stage of the overall Evaluation Framework focuses on deriving measures and/or estimates of the indicators identified in the stage of the “Evaluation Criteria Development Process” as required for the evaluation of a specific project and/or a specific set of actors.

Having identified the indicators relevant to the evaluation of a specific project, the question then arises how to measure or estimate them.

The specification of both the evaluation indicators to be used (the first stage) and their measurement (the second stage) is particularly important to IMO and its potential impact on Area Development if any added value of IMO compared to uni-modal transport investment is to be captured by the evaluation. Having said that, the key steps in the measurement/estimation process are not fundamentally different for IMO. However, the content of each step is likely to require some modification or extension to the measurement process used in conventional transport evaluation.

Figure 4.7 shows two key steps in the measurement/estimation process, namely:

- collection, collation and analysis of empirical evidence and
- forecasting/backcasting.

Each step is summarised in the following text. The output from the steps, shown in Figure 4.7, is a set of measured/estimated evaluation indicators. These are termed evaluation criteria to reflect that some indicators elaborated in the measurement stage may have no impact of relevance to the decision-making process and hence need not be taken as input to Stage III of the evaluation process.

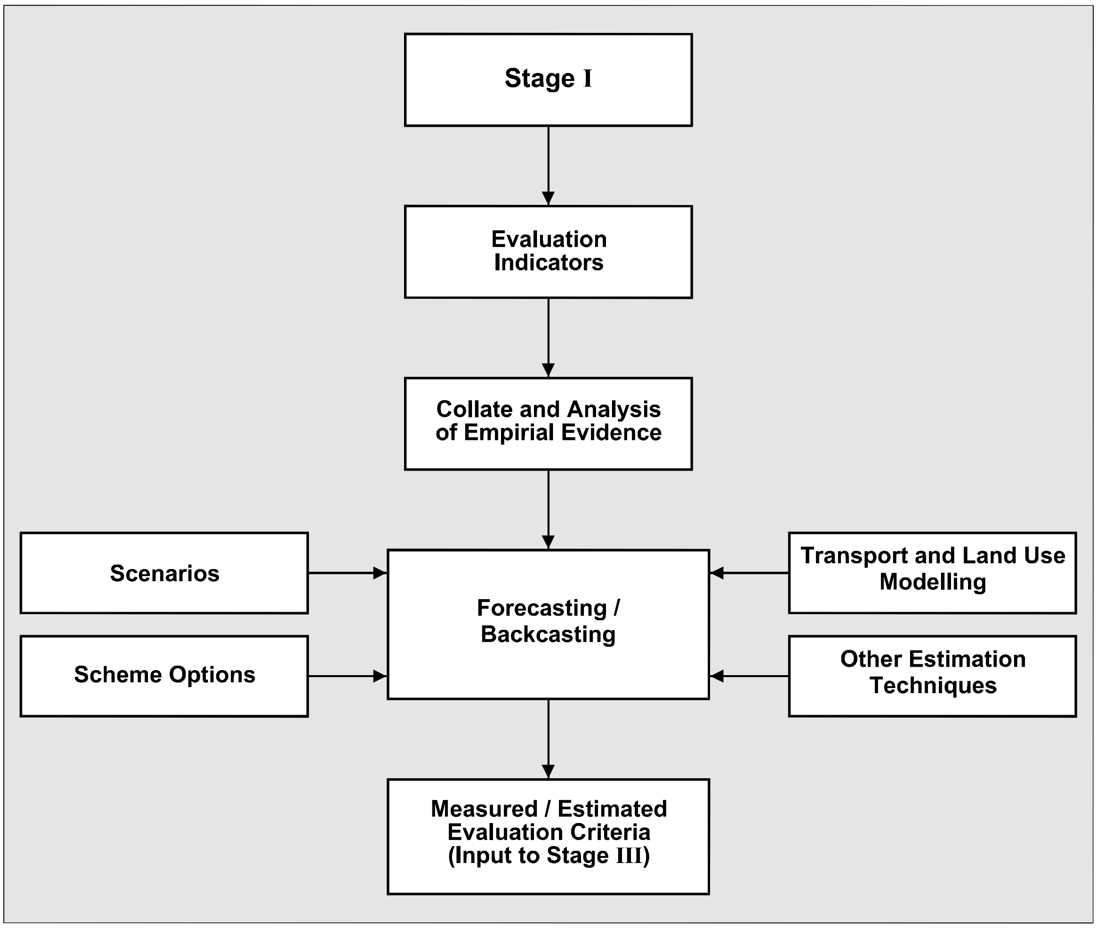

Figure 4.7: Stage II: Measuring and estimating indicators

4.3.1.1 Collection, collation and analysis of empirical evidence

Clearly the most accurate way of measuring indicators is to draw on actual empirical data. There are at least three areas where such data can be used:

- before and after comparison of empirical data as part of ex-post evaluation where the same data is collected and analysed before and after implementation of the transport project;
- as a base case for establishing conditions and features of travel, transport and land-use conditions at a point in time. This may then be used as the starting point from where to start a forecasting or backcasting process;
- as a means of establishing relationships as input parameters to a forecasting or backcasting process. Time series and cross-sectional analyses are both of relevance here.

With regard to IMO it is important that data sets are sufficiently specified to allow the properties of IMO to be identified as distinct from the properties of the transport system as a whole. For example, information on interchanging and trip chains is vital and can often be overlooked by conventional transport demand surveying. Also, the availability of time trend data for IMO is limited given that intermodality and interoperability have only recently been given prominence in transport planning.

One limitation of relying solely on empirical evidence as the means of measurement (in addition to the obvious constraints of costs and feasibility of data collection) is that it is often difficult to isolate the effects of a transport project form exogenous factors. Empirical data often provides evidence of aggregate outcomes without attributing these outcomes to specific actions/events. For example, employment change as a result of improved accessibility afforded by a specific transport project as opposed to regional economic growth, increased car ownership etc., is difficult to identify. With IMO the problem is augmented given that it is hard to specify measurable data that enables any added value of IMO, as distinct from the transport system in general, to be obtained.

A second limitation is clearly the fact that ex-ante transport evaluation involves a view of the future and, hence, empirical data cannot provide a measure of the indicator where this indicator involves a change resulting from a future event.

These two limitations give rise for the need for forecasting/backcasting as the second key step in the second Stage of the overall evaluation process as shown in Figure 4.7 .

4.3.1.2 Forecasting/Backcasting

Forecasting and backcasting has a role to play in estimating the indicators required for measuring the effects of a transport project as part of the evaluation of the project. Forecasting and backcasting can also be used to estimate the effects of exogenous factors, which are likely to influence the indicators being measured.

Figure 4.7 shows two important inputs to the forecasting/backcasting process.

Scenarios enable alternative views of the future to be considered in the evaluation process enabling indicators to be measured and compared under different assumptions about future events.

Long term planning decisions must be as robust as possible to withstand changes in the policy environment. Scenario analysis in this respect can be used to identify, anticipate and assess policy options for the future in an environment of uncertainty.

Potential benefits of policy scenarios to decision-making can be:

- The provision of useful frameworks for decision-making, as these allow issues to be explored by using a range of alternative scenarios, which reflect different assumptions about the future.

- The identification of risks and opportunities through a range of alternative futures which increases the likelihood of identifying possible problems and opportunities in policy-making.
- The suggestions of a variety of possible approaches for tackling issues or problems generated by the use of forecasts based on single theories or extrapolations which often lead to the pursuit of single solutions, and
- the increased creativity and choice in decision-making results from the identification of possible future developments, avoiding thus the acceptance of current trends as inevitable and opening up new possibilities for policy development.

Scheme Options need to be considered as part of the evaluation process to ensure that the transport investment is optimised and that alternative solutions are appraised. The measurement stage therefore has to be able to measure/estimate differences between different transport options for each of the selected indicators. Again this is particularly important if any added value of IMO over conventional transport is to be captured in the evaluation process.

Figure 4.7 shows two means of forecasting/backcasting indicators of IMO projects and their impacts on Area Development:

- transport and land use models
- other estimation techniques

Other estimation techniques have been included here in order to make explicit the recognition that transport investment decisions can be made on the basis of estimated effects derived without employing any formal modelling process. Expert judgement may give a good overview in many cases. It can also be used if suitable data for modelling is not available or is hard to collect. This kind of evaluation should be applied in a systematic manner in order to get reliable results. Well-established methods (such as the Delphi method) have been applied in the transport appraisal process in the past but are not elaborated on in EUROSIL.

4.3.1.3 Transport and Land-use modelling

The use of models in the assessment of transport infrastructure improvements is standard practice in the EU. A broad range of methods have been adopted. Conventionally, models are used to assist in (Batten et al, 1997):

- initial scheme identification;
- forecasting scheme impacts - the traditional transport impacts in terms of demand and revenue, as well as environmental impacts;
- risk assessment - generally through systematic sensitivity tests;
- scheme evaluation; and
- backcasting - i.e. to assist with ex-post evaluation.

Models are developed for a range of different purposes within a range of different contexts. Models should be sensitive to the specific characteristics (which may be physical or behavioural) of the study areas which they cover. Rigid modelling guidelines for all types of application are therefore not regarded as helpful.

Different models are appropriate in different circumstances (e.g. in terms of spatial coverage and detail, temporal coverage, modes represented, etc.). Moreover, a model needs to be tailored to represent the specific region or corridor to which it is to be applied. What is important, however, is that whatever model is employed (or is developed from new) conforms to a number of technical and functional specifications.

Modelling methodologies for dealing with the interactions between transport supply and demand and predicting the transport impacts of schemes are well established. EUROSIL, however, focuses more specifically upon the Area Development impacts of strategic transport improvements related to Intermodality, Multimodality and Interoperability. A review of methodologies currently in use for assessing the impacts of interest to EUROSIL concluded that many modelling frameworks fail to deal with IMO issues in an appropriate manner and, invariably, do not provide any assessment of Area Development impacts (see Deliverable 7).

The same review, however, identified a number of modelling techniques that have been developed and applied which are able to address both IMO and Area Development impacts. Some of these techniques have been developed as part of other EC-funded research projects, while others have been employed within the EUROSIL project as case study applications.

4.3.2 The recommended modelling framework

4.3.2.1 Objectives

This section sets out a recommended modelling framework for the assessment of the Area Development impacts <u>and</u> transport impacts of strategic improvements to IMO.

It is recognised that there are dangers about being too prescriptive on modelling techniques and/or on the use of existing models and modelling software. We distinguish between the following:

- modelling techniques which define the general methodology adopted to deal with specific transport and land use-transport interactions;
- existing models – e.g. STEMM (1997), TRANUS (De la Barra et al, 1984), MEPLAN (Echenique et al, 1990; Mackett, 1991b) – which have been developed for specific applications applying particular modelling techniques; and
- generalised modelling software – e.g. TRIPS, EMME/2 – which permit models for specific applications to be constructed applying various modelling techniques as developed using the various modelling tools available within the software package.

The recommended modelling framework is defined on the basis of a series of modelling techniques, in the form of **guidelines**.

4.3.2.2 A Generalised Modelling Framework

A generalised modelling framework is illustrated in fig. 4.8 below. This generic structure is presented as appropriate for IMO modelling, though it incorporates a number of areas which require further research and development even in terms of conventional modelling applications. The key stages of the framework are discussed in outline below and important issues relating to the key elements of the modelling framework are summarised. We have, for convenience, distinguished between modelling

- the transport element and
- the Area Development impact element.

Clearly both elements need to be represented and inter-related within the modelling framework.

The general structure of the framework above applies equally to models designed to assess the impacts of freight and passenger IMO schemes. Much of the discussion on issues below also applies equally in both cases. There will however be a number of important distinctions in practice between the detail of the approach adopted to modelling freight IMO and passenger IMO. The factors governing travel decisions for freight and passengers are often different. Such distinctions are highlighted where appropriate in the following text.

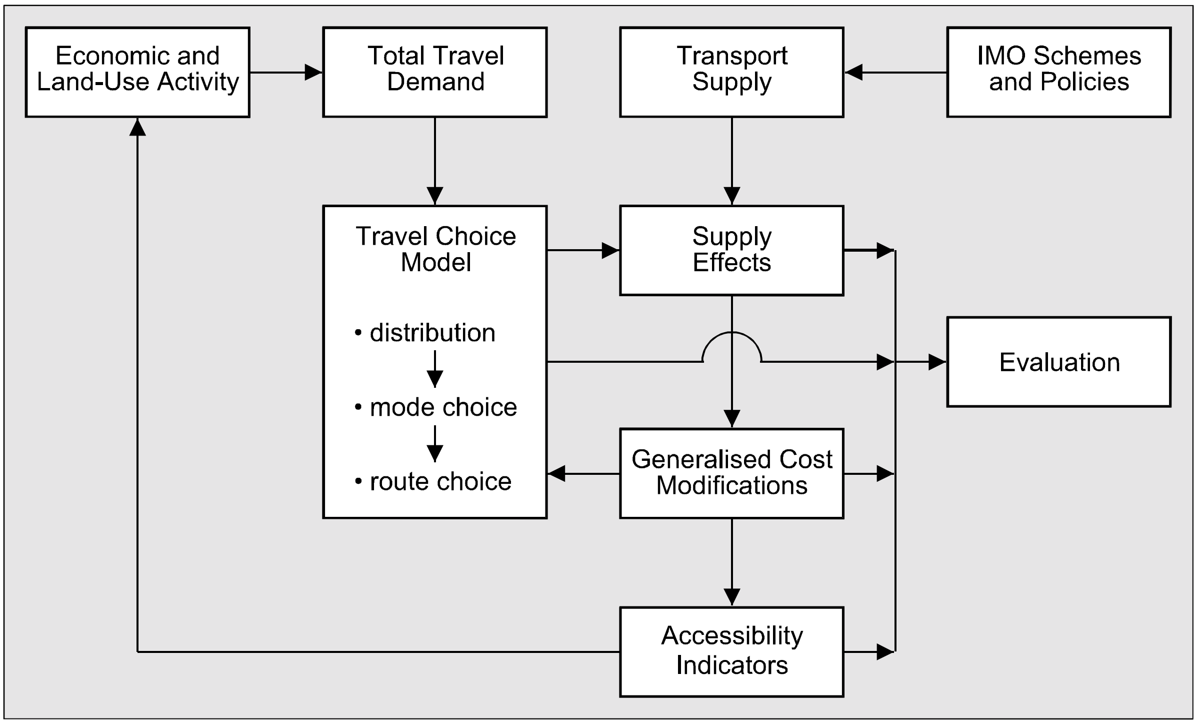

Figure 4.8: The generalised Modelling Framework

4.3.2.3 Modelling guidelines for the transport component

The various EUROSIL case studies provide a reasonable cross-section of the types of models used to represent transport supply and demand at the strategic and peri-urban level. Overall, there is a broad consensus amongst transport modelling professionals on what constitutes “best practice” in the development and application of such models.

Total Travel Demand

Demand data is crucial to any transport modelling application. These general considerations and requirements regarding sources of data, data segmentation and the forecasting of overall demand levels are equally as applicable to IMO modelling as to transport modelling in general. However, IMO modelling does feature a number of specific requirements in this respect.

The way in which passenger or freight demand is segmented comprises a key consideration for successful IMO modelling. As highlighted above, conventional modelling often adopts a level of segmentation, which may be regarded as sub-optimal in terms of representing inter-modality and interoperability. The point is illustrated with reference to freight transport, where different commodity types have significantly different cost functions for different modes and inter-modal transfers.

It is recommended therefore that careful consideration is given to demand segmentation in the specification of IMO modelling approaches. This is likely to have important implications for the way in which data collation and surveys are undertaken.

Transport Supply

The approach to representing transport supply is critical to the modelling of IMO, because it has to insure that the principal features of IMO schemes and policies are represented.

There will be a need to adopt a modelling approach, which is capable of representing any characteristics of IMO schemes and policies, which influence the way in which travel decisions and choices are made. The physical features associated with interchange need to be represented in a relatively straightforward manner by means of time, distance or cost penalties included within network representations of transport supply. There are difficulties however in representing many of the organisational and institutional aspects in a generalised form, and therefore advancements in modelling techniques are required in this respect.

Some form of network (transport supply) representation will be essential to model IMO impacts. In assessing how an IMO model network should be specified, particular attention needs to be given to the extent to which the network is capable of representing the key features of each specific IMO scheme

The level of spatial disaggregation and the level of detail at which modes and routes should be defined will depend upon individual circumstances. For highly strategic studies, such as major Trans- or Pan European connections, the network is likely to be based on very large zones and only broadly defined transport links. For more detailed applications, such as peri-urban studies, then greater spatial and network detail will be essential. In addition, in urban environments representation of highway congestion is likely to be essential. As discussed above, it is considered inappropriate to be more prescriptive about the precise level of detail of the network.

It is noted that most transport planning software available to model transport networks is geared towards representing passenger rather than freight transport. This means that many of the attributes of a freight transport network are difficult to explicitly represent in a model: for example, tariffs, constraints on movement or drivers' hours imposed by legislation, and, in particular, terminals and inter-modal interchanges. An exception is the STREAMS project which has developed the model designed to provide forecasts of the patterns of mobility and of freight and passenger flows.

The model permits explicit modelling of strategic intermodal linkages and inter-modal passenger trips across the entire EU. STREAMS has also sought to develop functions which enable the impact of improvements to intermodal transfer and/or interoperability to be represented. Mechanisms have been applied to represent intermodal interchange costs which extend the state-of-the-art.

Travel Choice Model

Modelling mechanisms are required by which total travel demand is allocated to specific corridors, modes and routes taking account of transport supply and levels of service. Such mechanisms are standard features of most transport modelling applications, and specifically of the conventional and well-established four-stage modelling approaches.

Choice models can be specified on different levels of complexity. In the context of IMO, a minimum requirement will be that the model is capable of addressing distribution as well as mode and route choice. The level of complexity applied to the modelling of the respective travel choices will depend upon the specific characteristics of the IMO scheme being assessed. In any event, there will be a need to ensure that intermodal options are sufficiently specified to avoid biasing demand towards single mode routes whilst adequately representing perceived deterrence of interchange.

The modelling approach should employ some form of choice model which estimates the proportion of total demand on each mode/route based on the generalised costs of the different alternatives

The various alternatives (as combinations of route/mode/intermodal interchange points etc.) generated by the network models for individual origin-destination movements need to be used in a choice model. Again it is considered inappropriate to be prescriptive about the form of the choice model employed since different techniques and formulations are considered by many practitioners to be valid. Nevertheless, it is critical that the choice model employed is formally linked to the network model(s) and operates using consistent levels of detail.

Supply effects

The travel choice models provide a basis for combining total travel demand and transport supply representations to estimate supply effects. Models will be required to examine the sensitivity of transport supply conditions to changes in demand levels, conventionally, for instance, through measures such as speed/flow curves. In the IMO context, methods should be considered for representing any impacts of alternative demand levels on transport supply with particular regard to cost, convenience, time, distance and perception of alternative modes, or of interchanging from one mode to another.

An essential step in modelling IMO schemes will be the identification of the key characteristics of IMO schemes and measures, and how these could change with alternative demand levels. Where such demand-related supply changes are significant in

terms of the ability of the IMO scheme to meet its objectives, there will be a requirement to represent an appropriate level of sensitivity to demand within the model

Because of the specific requirements of modelling intermodality - the need to explicitly represent inter-modal interchanges - being able to identify and select realistic paths through the transport network in a rigorous manner is fundamental. As noted above, it is considered essential to represent inter-modal interchange points and means of access to and egress from terminals for certain types of transport modes. It is equally important to employ techniques which permit a set of feasible **competing route/mode combinations** to be identified using the types of multi-routing path building techniques available in most state-of-the-art transport modelling software packages.

Although not necessary in all applications, it is generally recognised that the impact of congestion on the performance of Trans-European road network is important. Moreover, in terms of Area Development, the constraining effect of **congestion** on accessibility could be important. Thus, consideration should be given to representing the interaction between highway demand and supply (i.e. capacity) within the modelling framework, particularly where road-based passenger of freight transport is being considered in a regional or peri-urban context.

Generalised cost modifications

Changes in transport supply (and the demand/supply relationship where this is relevant) arising from IMO schemes need to represented as modifications to generalised costs. The concept of generalised cost is commonly adopted in modelling to allow different travel options, comprising different trip attributes to be compared directly. Generalised cost can comprise a range of out-of-pocket costs, journey times, and less directly quantifiable attributes relating for instance to the traveller’s perception of comfort, quality, interchange and reliability.

This has important implications for IMO modelling, given that IMO travel choices for both passenger and freight will be made on the basis of a range of trip attributes which extend well beyond travel time and distance. The concept of interchange (both for passenger and freight) is central in this context, and, accordingly, there is a particular requirement to represent interchange in an appropriately weighted manner as part of the definition of generalised cost for IMO trips.

Generalised cost typically comprises a number of key elements, often expressed on a common time basis for the purposes of modelling, by using behavioural value of time estimates as a conversion factor:

- in-vehicle journey time;
- in-vehicle journey distance;
- journey operating cost;
- access time to the network;
- waiting time (public transport);
- interchange time;
- interchange penalty (the perception of the cost of interchange).

Particular emphasis falls within this context upon an accurate representation of:

- Access time between modes;
- The perception of passengers to modal switch;
- Freight handling charges at transhipment points;
- Freight transhipment time;
- Procedures (freight and passengers) at national borders;
- barriers to interoperability between modes (through-ticketing, border crossings, insurance, etc.);
- security (freight transport)

In general terms, there is a clear need to represent impacts of changes in attributes not normally included in transport model generalised cost formulations. In many cases, especially for freight movements, these are thought to be more important in determining choice of mode than conventional time and cost attributes.

Accessibility indicators/ economic and land use activity

The concept of accessibility represents the key link in the generalised modelling framework between transport and economic / land use activity (Hansen, 1959; Hund and Simmons, 1993; Johansson, 1993). Accessibility can be represented at a number of different levels of complexity (Mackett, 1990b), as discussed further below. Accessibility is generally represented as a travel impedance measured as a function of generalised cost.

Where there is a requirement to examine the area impacts of IMO schemes, careful consideration will be required of the method and complexity associated with the representation of accessibility. This is discussed in conjunction with modelling Area Development impacts.

Representing changes to IMO

Research and modelling of intermodality, interoperability and multimodality aims to investigate and estimate how users (agents) respond to changes in intermodality, interoperability and mulitmodality. In other words which are the key factors related to those concepts and what value do they place on these changes?

In general modelling interoperability, intermodality and multimodality should consider:

- The use of the transportation network;
- The requirements of users and operators of the network;
- The responses of agents to characteristics of the network as well as the urban and regional system
- The responses of firms to the characteristics of the network as well as the urban and regional system

Representing multimodality

Multimodality represents the ‘classical’ and well-documented mode choice problem. A particular example is the transport network between Paris and London, which is multimodal in offering road, rail and air connections. In contrast to intermodality, the emphasis in modelling multimodality is upon competition between different modes.

The specification of mode choice is usually performed within a sub-module of a transport model after the computation of the generation and spatial distribution of trips (e.g. the 4 stage models). Conventionally, formulations are applied which estimate the choice probability of selecting one mode out of a set of alternative modes for a specific origin-destination pair in terms of random utility theory. A set of indicators related to the quality and performance of the services of the transport modes are used as explanatory variables, such as:

- Total travel time costs (including access/egress costs);
- Net travel time costs (excluding access/egress costs);
- Total travel time (in-vehicle + out-of-vehicle + access/egress times);
- Net travel time (excluding access/egress);
- Access/egress distance;
- Total frequency/number of daily connections;
- Total number of transfers;
- Convenience of travel;
- Safety

Destination choice, route choice and mode choice are closely related. To represent this link, an option is to build hierarchical choice structures by integrating different choice levels in a decision hierarchy. A mathematically consistent way of achieving this is given by the framework of the Nested Logit Models.

Representing intermodal interchanges

Reference is made above to some of the key attributes associated with inter-modal interchanges. Fig. 4.9 below provides indicative examples of how improvements to inter-modal interchanges could be represented by adjustments to the trip attributes, and makes comments with respect to the weighting of co-efficients.

With the modelling of interoperability there is a particular need to represent the behavioural responses of both service providers who operate on a network (e.g. airlines or railway operators), and ‘end users’ (e.g. vehicle drivers, train passengers, or vehicle drivers on toll roads).

Improvements in interoperability are associated with organisational arrangements (especially for terminals and transfer points), and the removal of institutional, financial, physical, technical, cultural and political barriers. Particular emphasis in the EUROSIL context will be upon the optimisation of the interfaces between Trans-European and urban networks. Interoperability may occur between operations of one mode or between operations of different modes. In the latter case benefits may be derived through improvements in intermodality by reducing barriers to change mode.

Inter-modal scheme or initiative	**The ‘before’ case – factors represented in the generalised costs for the equivalent uni-modal trip**	**The ‘after’ case – factors represented in the generalised costs for the inter-modal trip**	**Comments**
New freight	Travel time from origin to	Freight transshipment time;	Local consideration

transshipment centre	destination; Operating cost from origin to destination; Freight handling charge at the destination	Freight handling charge at transshipment point; Operating cost from origin to transshipment centre; Freight operator perceptions of interchange (e.g. security/reliability)	required of relative weighting attached to trip attributes. Cost perceptions are conventionally represented as mode specific constants or penalties.
New passenger interchange facility (e.g. bus/rail interchange, or 'park and ride')	Travel time from origin to destination; operating cost from origin to destination; Parking charge at the destination	Travel time from origin to interchange point; Transfer time, including access and wait time; Transfer cost (e.g. additional fare); Travel time from interchange point to ultimate destination; Traveller's perception of interchange (e.g. security/reliability)	In behavioural terms different values will be attached to each trip attribute. (e.g. access and wait time is commonly weighted at twice in-vehicle time). Cost perceptions are conventionally represented as mode specific constants or penalties.

Figure 4.9: Improvements to intermodal interchanges represented by adjustments to the trip attributes

There are a number of impacts associated with interoperability. These are listed below, with further consideration given in the following sections with regard to general procedures for taking these into account, where feasible within a model:

- Regional integration for cross-border areas;
- Institutional improvements such as abolishing administrative barriers;
- Open markets and deregulation;
- Technical improvements at intermodal nodes;
- Different standards;
- Transparency of processes;
- Better vehicle/vessel/container design which ensures efficient processing and handling at transfer nodes and borders;
- Interregional multimodal trips reduction in relation to direct single modal trips

In principle there is no problem in incorporating any of these impacts within a modelling framework, provided that they can be represented in generalised cost form. There are difficulties however in representing many of the organisational and institutional aspects in a generalised form, and there is an acknowledgement that further research is required in this area. In particular, until now strategic transport models have not been sufficiently detailed to provide clear business guidance based on the requirements of the different agents within the transport system. Existing models are not sufficiently specified to represent different ticketing and incentive schemes.

Interoperability is not currently a common output of a model. Based on a number of current model applications, consideration should be given to representing indicators relating to interoperability in a number of ways, either implicitly or explicitly:

- with economic and econometric models interoperability effects can be included implicitly in the way in which barriers are treated, or the elasticities adopted to represent user behaviour on international trips;
- interoperability factors could be expressed by compatibility criteria concerning, for instance, transport units, loading gauges, velocities, weights, etc;
- time values representing, for instance, time transfer could be used to represent the concept of interoperability;
- generalised cost values could be varied to represent different types of barriers such as distance, market concentration and traffic levels.

4.3.2.4 Modelling Area Development impacts

Modelling Area Development impacts requires some form of land use-transport interaction modelling framework. Although much research and model development has been undertaken, it must be acknowledged that experience in this area is far less extensive than that for models, which deal only with transport. This is a function of the complexity of land use-transport models. It is therefore more difficult to establish hard and fast rules to which land use-transport models should conform if they are to adequately deal with multimodality, intermodality and interoperability.

Given the guidance on the form of the transport model regarding the inclusion of costs of intermodal transfer (and if appropriate differences in cost affected by interoperability) within a generalised cost function, it is absolutely imperative that the land use model employs the generalised cost from the transport model in some form. Without this, land use impacts cannot be directly influenced by changes in the transport system which improve inter-modality or interoperability.

Based on the EUROSIL review of the state-of-the-art of land use-transport interaction models broadly identified three different levels at which linkage between the transport and land use components could be addressed. These are as follows:

- using simple accessibility measures with Area Development effects inferred without any formal feedback from the land use component to the transport component (i.e. the approach that seems to be used in most of the case studies); or
- a composite model with land use and transport sub-models which are linked within an overall model structure allowing feedback between the two sub-models and the opportunity for each sub-model to achieve some form of equilibrium (e.g. TRANUS, see Deliverable 7);
- a unified model which attempts a simultaneous treatment of land use and transport (e.g. STASA model, see Deliverable 7)

When to use accessibility indicators

Accessibility indicators (without formal feedback between transport and land use models) are likely to provide the depth and accuracy of analysis suitable only for studies of a pre-feasibility nature. Different ways of measuring accessibility which may be helpful in the context of a pre-feasibility study are:

- Travel costs – total or average travel time or cost to a specified set of destinations;

- Daily accessibility – this is based upon the concept of a fixed budget for travel, generally in terms of a maximum time interval in which a destination has to be reached to be of interest;
- Potential accessibility – this indicator is based on the assumption that the attraction of a destination increases with the size, and declines with distance and travel time and cost.

When to use integrated land-use transportation models.

More complex inter-regional studies are likely to require integrated transport/land use models. These are likely to feature land use and transport sub-models which are linked within an overall model structure allowing feedback between the two sub-models and the opportunity for each sub-model to achieve some form of equilibrium (e.g. TRANUS).

Such an approach is also likely to be required for major strategic schemes which could impact on Area Development potential of different regions.

Using accessibility Indicators

Accessibility is the main ‘product’ of the transport system. It determines the location advantage of a region relative to all regions (including itself). Indicators of accessibility measure the benefits households and firms enjoy within a region from the existence and use of the transport infrastructure relevant for their region. Accessibility is implicitly addressed in one form or another in most models, and within transport/land use models it frequently acts as the link between transport and regional development or land use sub-systems of their models. There is a large variety of approaches to measuring accessibility in modelling work to date. However, there have also been very few attempts to empirically demonstrate that accessibility, as economic theory suggests, has had significant influence on regional development impact.

Recommended form of accessibility indicators

The most commonly used types of accessibility indicator are:

- Travel cost – measuring the accumulated generalised costs to a set of destinations. These are popular because they are easy to interpret; the disadvantage is that they lack a behavioural foundation because they ignore that more distant destinations are visited less frequently. Examples include the BfLR 1993 study for DG XVI calculating accessibility in the NUTS-3 regions (see Deliverable 7);
- Daily accessibility – this is based upon the notion of a fixed budget for travel, generally in terms of a maximum time interval in which a destination has to be reached to be of interest. These indicators are easy to define and understand however they are heavily dependent upon arbitrarily selected maximum travel times beyond which destinations are no longer considered. Examples include the UTS study (Chatelus and Ulied, 1995);
- Potential accessibility – based on the assumption that the attraction of a destination increases with size and declines with distance or travel time or cost. Such indicators are based upon sound behavioural principles; however, they contain parameters which need to be calibrated, and cannot be interpreted in familiar units such as travel time or number of people. Keeble at al. (1982; 1988) analysed the centrality of economic centres in Europe using a gravity potential with regional GDP as destination activity.

An almost unlimited number of indicators can be derived from the these three basic indicators. From the EUROSIL point of view the most important ones are multimodal, intermodal and interoperable accessibility. In each case the equations for underpinning the three indicators remain valid – what changes is the way in which transport cost is calculated.

Linkages with the transport model

To apply accessibility indicators in the IMO context in an appropriate manner, there is a need to ensure that the indicator takes account of the generalised cost formulation in the transport model (incorporating IMO attributes). This will be feasible in cases where indicators such as travel cost and daily accessibility are capable of incorporating specific IMO-related costs.

Using Integrated Land-Use Transport Models

Key model criteria

There are a number of issues associated with the specification of integrated land-use transport models, which are relevant also in the IMO context. These include:

- linkage with a transport model
- whether a composite or unified approach should be adopted? Further discussion in this context is given below;
- Whether the model is designed to address inter-regional and/or intra-regional impacts.
- The model outputs required to assist in identifying Area Development impacts

With respect to overall model structure, two groups can be distinguished. One group of models searches for a unifying principle for modelling and linking all subsystems; the others see the city as a hierarchical system of interconnected but structurally autonomous subsystems. The resulting model structure is either tightly integrated, ‘all of one kind’, or consists of loosely coupled sub-models, each of which has its own independent internal structure. The former model is called ‘unified’, the latter ‘composite’.

For the purposes of assessing impacts of multimodality, intermodality and interoperability it is considered that composite models are preferable. This is primarily because, if appropriately specified, they offer the benefits of permitting separate transport and non-transport sub-models (which can in theory be estimated and applied separately) along with a mathematically consistent link via costs from the transport model and demand from the land use model. In principle it is to be expected that, because of their structure, composite models will be easier to develop and offer greater flexibility in application.

Another important area for consideration concerns whether the modelling framework should address inter-regional impacts, intra-regional impacts or both. Effectively this means: Should the model focus on the distribution of regional economic development (new jobs etc.) amongst regions, or on the distribution of jobs, land uses etc. within a single region? It is noted that of those case study models which do address land use-transport interaction all only address inter-regional impacts. It is clear that, in order to address the full impacts of multimodality, intermodality and interoperability on Area Development, both inter-regional and intra-regional impacts must be considered.

Recommended approach

The guidelines set out above are deliberately general in nature. In practice, the detailed specification of the methodology adopted will be dependent upon the objectives of the modelling exercise (such as the level of detail required, and the type of impacts to be examined) and on the characteristics of the study area concerned. An over-riding consideration however is that the model specification should be undertaken only in the light of a clear understanding of the outputs required from the model.

Using existing available integrated land use-transport models

It is likely that existing integrated land use/transport model (TRANUS, IMREL, MEPLAN) will be transferable for applications elsewhere only to a very limited extent. This is because these models tend to be calibrated very specifically to local conditions and circumstances. Nonetheless, reference to aspects of the methodology used on these models may assist in the development of models for other areas.

4.4 GUIDELINES ON THE EVALUATION/ASSESSMENT PROCESS (STAGE III)

The specification of both the evaluation indicators to be used (the output of stage I, see figure 4.2), the measurement of these indicators (stage II) and the identification of criteria and values attached to each one of them (stage III) is particularly important to IMO and its potential impact on Area Development if any added value of IMO compared to uni-modal transport investment is to be captured in the evaluation. The first two stages, and particularly the evaluation criteria development process (the first stage) should be oriented more specifically to IMO and its impact on Area Development. However the third stage, the evaluation process is crucial in ensuring that appropriate values are attached to the measured impacts of IMO that are commensurate with policies that advocate IMO, not least the EU Common Transport Policy, and appropriate evaluation methods are used to provide decision makers with sound results. The key steps in the evaluation process are not fundamentally different for IMO. However, the content of each step is likely to require some modification or extension to that used in conventional transport evaluation if the evaluation of IMO and its contribution to Area Development often implicit in transport policy and project identification, are to be fully reflected in the evaluation process.

4.4.1 Overall Approaches to Evaluation

The notion of evaluation can be defined as a set of activities aimed to classify and conveniently arrange the information needed for a choice so that the various participants in the choice process can make this choice as responsibly as possible. Formalised evaluation methods assist in providing the maximum transparency in decision making. The choice of a method depends – apart from personal preferences of the decision-maker – mostly on the kind of impacts relevant to the decision-making process. In general, there are four types of indicators, which influence the choice of the evaluation method, namely:

- financial indicators,
- indicators which have imputed money values (e.g. social cost benefit analysis),

- indicators which have physical values with no imputed money values,
- intangible indicators, which can be appraised but not, measured.

Various kinds of evaluation can be distinguished in a planning process.

Both for ex ante and for ex post an important distinction can be drawn between the first two types of indicators (**monetary evaluation**) and the second two (**non-monetary evaluation)**. A monetary evaluation is characterised by the attempt to transform all effects in monetary units, whereas - in contrast - a non-monetary evaluation utilises a wide variety of measurement units to assess the effects. Cost-benefit analysis is a well-known example of monetary evaluation.

Also a distinction can be made between an **explicit** and an **implicit evaluation**. In the case of an explicit evaluation an explicit systematic analysis is pursued whereby the activities are focused on the transparency and accountability of the final results. An implicit evaluation – on the contrary – focuses on the consensus of thought whereby attention is directed towards the participation of – and negotiations between – all parties concerned.

Two main types of evaluation approaches can be distinguished in this respect. Firstly Cost-Benefit Analysis (CBA) uses monetary units to quantify impacts and hence tends to be explicit in presenting the costs and benefits of a project. However, over the years, monetary evaluation approaches are increasingly seen as being limited. There are often considerable difficulties in measuring all the impacts of a project or plan in monetary units. Although many efforts have been undertaken in transport evaluation to arrive in values for intangible and externalities, it is frequently almost impossible to place anything more sophisticated than arbitrary numerical or ordinal values on such effects. Besides political priorities cannot be taken into explicit account in such a monetary evaluation. Due to these important limitations monetary evaluation has been complemented and partially superseded in the last decade by non-monetary evaluation methods, namely Multicriteria Analysis (MCA)

The Cost-Benefit set of methods and the Multicriteria Evaluation Methods can be considered as the most prominent streams of evaluation methods. Cost Benefit Methods deal with quantitative aspects of the problem at hand, while Multicriteria Methods can cope with qualitative aspects as well. The major strength of MCA is that it addresses - in an operational sense - evaluation and choice problems marked by various conflicting interests. The aim of MCA is to provide in a systematic way information on the nature of these conflicts, so as to make the trade-off in a complex choice situation more transparent to a decision-maker. The weighting that is introduced into the analysis reflects the community's valuation of each of the various objectives and its valuation of appropriate incidence of benefits and costs.

There are further key issues in which the evaluation methods may differ such as:

- the definition of objectives and indicators,
- the fundamental principles and sources from which values are derived,
- the measurement units in which the values are expressed on a consistent basis (standardisation),
- the methods used for aggregating values incurred at different periods of time and with respect to different groups affected,
- the distribution of impacts across various stakeholders and how these are trading off.

A very important component in the context of multidimensional evaluation methods concerns the priorities attached to the various criteria. These priorities can be expressed either by means of quantitative numbers, usually denoted as **weights**, or by means of ordinal expressions, usually denoted as **priorities** (Voogd, 1983). The weighting that is introduced into the analysis reflects the individual or general valuation of each of the various objectives and the valuation of appropriate incidence of benefits and costs.

Cost-benefit analysis

Cost-Benefit Analysis (CBA) is an evaluation method transforming all impacts of a decision into monetary units, in order to make alternative plans mutually comparable in terms of net benefits. There are a lot of variations of CBA, e.g. Conventional cost benefit analysis, Fiscal cost benefit analysis.

The economic evaluation of the physical effects of transport leads to the estimation of costs and benefits. The weighting (values) takes place implicitly in the monetarisation process by allocating cost-levels to the indicators. The evaluation process has crucial influence on the size of these benefits and costs. Customary monetarising approaches to costs and benefits are:

- Damage-cost-approach
- Avoidance-cost-approach
- Willingness to pay/willingness to accept-approach
- Market-data-divergence-analysis

Multicriteria evaluation methods

Multicriteria Evaluation Methods are defined as evaluation methods, which employ criteria in both quantitative and qualitative units. A broad range of Multicriteria Evaluation Methods exists with diversified attributes and procedures. Representing, the following four can be taken:

- **Utility-Value analysis**: in which criteria can be measured on either a cardinal scale (quantitative criteria) or an ordinal scale (qualitative criteria). Utility-Value Analysis or other decision techniques which process ordinal scaled criteria in a theoretically consistent way, can usually not fully solve the multi-criteria problem. Therefore, some additional assumptions about the ordinal levels or ranks must be made; for example, it is often assumed that the utility difference between two adjacent ranks is constant. Under such additional assumptions qualitative judgements can formally be expressed with value functions which are non-continuous step-functions (e.g. five ranks like "very good, good, fair, satisfactory, unsatisfactory"). The basic procedure is then the same as in quantitative Utility-Value Analysis.

- **Cost Effectiveness Analysis**: a method lying in between Cost-Benefit Analysis (CBA) and typical Multi-Criteria Analysis. The costs of a project are measured and evaluated like in CBA in monetary values whereas the benefits are measured like in MCA in other units, which are then combined into a single indicator of effectiveness

- **Compatibility analysis**: is an MCA-technique which aims to avoid value judgement implied in aggregating different criteria. Instead of an aggregation, a 'quality profile' is designed showing for each criterion separately the level of achieving the desired objective. The quality profile is the difference between an 'impact-profile', which shows the impacts in their original physical units, and the 'demand profile', which shows the desired targets for each criterion. A comparison between the quality profiles of different alternatives reveals for each criterion advantages and disadvantages of the alternatives. The decision can then be based on this comparison. As there is no transformation into single-unit utilities a ranking of alternatives cannot be made by simple grading. The pros and cons of each alternative expressed in the quality profile must be described and the final decision must be justified by the decision-maker.

- **Regime method**: in which the choice problem is dealt with explicitly through weighting and ranking.. This enables the combination of qualitative and quantitative data. The most powerful characteristic of the Regime Method lies on its ability to handle both qualitative and quantitative data (mixed data). The attached priorities can again be presented as quantitative numbers (usually denoted as weights) or by means of ordinal expressions (denoted as priorities). Thus weights and priorities can be thought as substitutes of each other depending on the way they are expressed.

In any MCA, the decision-maker or the evaluator has to create his system of priorities. Additionally the importance of the various criteria inside this system of objectives has to be reflected within the **weighting procedure** by assigning weighting factors to these criteria (Van Delft and Nijkamp, 1976). Examples for possible manners are:

- Direct estimation of weights
- Trade-off method
- Rating Method
- Statements on Weights
- Paired Comparisons
- Indirect estimation of weights
- Weights based on previous choices
- Weights based on a ranking of alternatives

Possible ways to determine sets of weights or priorities are (Voogd, 1983):

- **Preference analysis** involves the direct questioning of people by means of interviews, questionnaires or any other kind of interactive procedure aiming at gaining insight into the value-trade-offs.
- **Behavioural analysis** focuses more on the actual behaviour of people with respect to similar problems at hand.
- **Direct system description** uses weights, which are representing a measurable characteristic of an aspect used as a criterion, and is less well known in multicriteria evaluation.
- **Indirect system description** implies an indirect approach to weight estimation.
- **Hypothetical priorities** involves a postulation of criterion rankings from the perspective of various view points or visions, such as policy directions, scenarios, planning sectors, etc.

MCA methods involving value functions require a high level of impact analysis. Therefore, in some cases a more simplified classification of project impacts might be appropriate, especially because this method allows the integration of intangibles. Although it can be questioned from a theoretical point of view, it is possible to assign individual criteria weights and sum them up. This will allow a simplified comparison and ranking of the evaluated projects. The so-called "simplified manual for property rating" presented in the Annex of the public Deliverable 9/10 of EUROSIL demonstrates this approach in the field of IMO properties and impacts related to Area Development aspects.

As mentioned, the evaluation methodologies, developed for traditional assessment procedures for mono-modal projects, are not considerably different from those dealing with projects introducing or improving IMO-related measures in the transport system and their impact on Area Development. In the following panel a general comparison is demonstrated, valid for uni-modal as well as for IMO-specific projects.

Comparison of CBA and MCA Approaches for evaluating IMO and Area Development Impacts

Over the years, monetary evaluation approaches have received rather hard criticism. These stem mainly from attempts of putting the underline welfare economic theory into practice. There are often considerable difficulties in measuring all the impacts of a project or plan in monetary units. Although many efforts have been undertaken in transport evaluation to arrive in values for intangibles and externalities, it is frequently almost impossible to place anything more sophisticated than arbitrary numerical or ordinal values on such effects. Besides, political priorities cannot be taken into explicit account in such a monetary evaluation. Due to these important limitations monetary evaluation has been complemented and partially been superseded in the last decade by non-monetary evaluation methods.

The main difference between CBA and MCA is that CBA is bound to monetary values whereas MCA provides a high degree of freedom to the decision making by incorporating qualitative aspects as well. MCA exceeds the allocative approach of CBA, which relies on consumers' preferences or resource consumption. Instead, the objectives of the decisions-maker serve as a basis to establish criteria and related values. This does not necessarily imply that criteria and values in MCA differ from those in CBA, but it means that MCA is more flexible in including objectives in both qualitative and quantitative form.

The monetarising process includes most of the problems and disadvantages imbedded in CBA (e.g. guarantee the completeness of costs and benefits, choose the correct monetarising method, convert the monetary values at market prices). CBA evaluates the alternatives independently against a "universal" background, i.e. their individual contribution to social welfare. A ranking of alternatives can be done according to the amount they add to social and economic welfare. An MCA evaluates the alternatives according to their relative ability to contribute to a specific goal-system (system of objectives) that could be based on social and economic welfare, too. The definition of this system of objectives by the decision-maker is an important step of an MCA evaluation. Within an MCA the decision-makers attach their priorities on the indicators and criteria used for the purpose of the evaluation. The MCA evaluation thus is not independent from the decision-maker and even the previous experience of the decision-maker does not apply for other evaluation given that the steps which are followed comprise a definition of the system of objectives, the assignment of value functions to the criteria and the weighting of these criteria. Moreover, giving previous evaluation results as an orientation to a new case for evaluation could be rather misleading.

Decision-makers can use their prerogative to support projects for political reasons. However, if value functions and weights become explicit, the political bias can be checked on the grounds of CBA.

4.4.2 EUROSIL Evaluation Guidelines

The outcome of stages I and II of the overall EUROSIL guidelines consists of the output concerning the criteria each evaluator has identified as relevant for the individual scheme or task at hand.

Until now, some effects of transport measures are rarely regarded in evaluation procedures, e.g. the following:

- visual aesthetic disturbances,
- disturbances for the residential area,
- improvements in accessibility,
- improvements in the division of labour,
- time application during the transport process,
- transport comfort and image.

Their consideration in Cost-Benefit Analyses requires monetarising the above effects, but the methodological and empirical basis for that process is often missing. Frequently, these aspects can be included in Multi-Criteria Analysis. Sometimes only a descriptive verbal supplement to the evaluation process is possible, which could be realised as follows:

- Basically, it has to be examined whether new factors are linked to the allocation of resources, which is a prerequisite for utilising Cost-Benefit Analysis.
- In case of consumption or a preservation of resources, monetary values have to be attached to of the factors under study. For this purpose should be explored whether already used attributes, e.g. time-costs can be directly or indirectly applied.

- An exhaustive list of criteria for a Multi-Criteria Analysis facilitates the inclusion of new indicators on the condition that these comply with the MCA requirements.

So, irrespective of the methodology, within the various steps of carrying out the evaluation process, it will be necessary to modify the process or enlarge the perspective of the evaluators in order to ensure that the individual characteristics of IMO are adequately considered.

Due to the specific aspects and complexity of IMO-related projects, an important task of the evaluation procedure would be to ensure transparency in the procedure and results of the process. Consequently, the emphasis will be on developing an explicit process rather than an implicit one.

In stage III - the Evaluation / Assessment Process - of the overall Evaluation and Modelling Framework, the purpose of the EUROSIL Evaluation guidelines is to provide support in the third step of evaluation process based on the outcome of stages I and II.

1. Selection of the Evaluation methodology
2. Determination of the measurement type
3. Valuing/weighting for the various, different actors
4. Comparison of the different alternatives

The first two steps 'Selection of the Evaluation methodology' and 'Determination of the measurement type' are closely interconnected and influence each other.

As mentioned above the choice of the method is not specific to IMO, however the case studies have shown that usually MCA is chosen due to the fact that generally several soft factors are considered relevant for which a monetarisation is seen not possible or opportune. However the combination of CBA within a MCA is considered promising.

As far as the measurement type is concerned, the following options are taken from DEFINITE*, /Janssen and van Herwijnen, 1994:/

- **Ratio**: the importance of an effect is measured on a ratio scale namely it is proportional of its value. Examples are the inhabitants of a city or the speed of a car.
- **Monetary**: is a special scale of the ratio scale. Effects on a monetary scale are measured in monetary units. Examples are income generated by a project or the investment costs of a project.
- **Interval**: this scale does not have a meaningful origin. This implies that only differences between effects are meaningful. An example is the temperature as measured in Celsius degrees. The statement that 40 degrees is twice as warm as 20 degrees is incorrect. However the statement that the difference between 20 and 40 degrees is two times the difference between 10 and 20 degrees is correct.
- **Ordinal**: effects measured in this type of scale are ranked only. For example the visual effect on the quality of the landscape for various alternatives can be expressed by indicating which alternative has the least effect, which alternative is the second best, until the worst alternative is reached. No statements can be made with regard to the size of the differences between alternatives.

---

* For more information on the DEFINITE Decision Support System refer to R. Janssen and M. van Herwijnen (1994): “DEFINITE: A System to Support Decisions on a FINITE Set of Alternatives”, User Manual.

- **Qualitative**: is a special case of the ordinal scale. The effects are ranked by assigning one ore more pluses or minuses (---/+++)
- **Nominal**: effects measured on a nominal scale cannot be used to rank the alternatives. These effects are no more than a specification of an alternative. Examples are the name of a location or the colour of an alternative.
- **Binary**: this scale only indicates whether an effect occurs or does not occur. It is necessary to indicate *whether* “yes” should be considered better than a “no” or vice versa. Violation or non-violation of an environmental standard is an example.

Within the valuing/weighting process the following four questions have to be highlighted:

- How are the identified criteria valued?
- How do the values change over time?
- How do the values vary considering actors, actor groups as well as variety in spatial levels and regions?
- How are the values then combined to reach an overall consistency?

In the following text the specific aspects of IMO and AD within these four tasks are highlighted, based mainly upon the experiences gained within the carrying out of the illustrative EUROSIL case studies.

Valuation of the identified criteria

The values to be attached to the criteria in the course of the evaluation process can be differentiated into:

- monetary values and
- non-monetary values.

Regarding the nature of the key properties identified in the KEP-development process (see section 4.2), it appears that only few properties are fairly easy to monetarise, while the rest are intangible and therefore better considered via non-monetary values.

Example:

Taking “Reliability” as a property which can be promoted to a considerable degree by investing in an IMO-related project. A possibility to integrate the impact of the change of reliability, would be to monetarise the total sum of additional time seen necessary by the users to add to the overall trip time to allow for compensation of the unreliable interchanges etc.

As this appears to be rather difficult, it might be easier e.g. to regard the ratio of punctual arrivals to trip frequency. At this point, it should be reminded that under reliability also other aspects (e.g. the overall safety feeling of the trip) are for more important for certain user groups. To avoid overlapping and to allow for a clear allocation of impacts, these aspects can be found within the exhaustive list of identified properties in the annex 1. It is therefore necessary to consult this list for the exact definition of the property.

For both possibilities, the monetary and the non-monetary evaluation, the values can be based on resource data or on perceived data.

Here the evaluator has to be aware that the behaviour of the IMO/Area Development-related properties can differ, depending upon the actor e.g. the perceived interchange time and here especially waiting time can obtain an exceptionally high value

Variation of values over time

The evaluation process is carried out either as ex-post in order to improve the understanding of events and their effects or as ex-ante in order to assess possible effects of potential measures. These effects are rather often to be evaluated in the context of future scenarios either with ceteris paribus or adapted e.g. to political aims.

The future trends are derived by means of well-established scenario analysis approaches, based on observations of longer time series.

IMO/Area Development-related aspects on the other hand have been thinly treated so far, which implies that the evaluator has to take into account the difficulties implied from limited experience for the decision making process.

Value variation due to the involved actors and the spatial level

Most of the IMO/Area Development-related projects encompass a wide range of actors, which implies a greater complexity of impacts to be considered and interdependencies within the evaluation process (Pearce, 1978).

Individual actors or actor groups perspectives may vary considerably in such a context. For example a seamless journey would be evaluated completely different from the view-point of a transport politician than from the one of an operator.

Employment and job creation on the other hand will vary in importance within different regions. The existing barriers of Interoperability identified at the various spatial levels reflect the different values when looking at border crossing projects and the values attached to the individual criteria.

Combining the values to achieve an overall consistency

When integrating various impacts into an evaluation procedure it is necessary to standardise the indicators. In the case of a CBA this procedure is/has been carried out with the monetarisation of indicators. In the MCA procedure this is achieved, among others, through the allocation of scores to the selected criteria by the evaluator, who has to be aware that in most of IMO/Area Development-related properties/impacts the value functions are not linear.

As examples may be used again the property “reliability” or the “interchange time”, which can rise exponentially when taking as basis the perceived time. Another example is the “information”, where according to the quality and amount of information, the value can be infinite if it allows the utilisation of intermodal transport chains compared to a non-existent information in the basic-case.

When combining the methodologies covering monetary and non-monetary impacts, the issue of double counting has to be taken into account. An example is when IMO-related aspects are sometimes a subset of the mono-model ones.

Another important aspect is the transparency and the underlying explicit emphasis. The impact distribution is a decisive point to be considered when interpreting the evaluation results of a measure. Gains and losses might on the whole be compensated but, regarding specific involved actors the individual results might differ considerably.

In the context of the MCA the indicators turning into criteria have to be weighted.

Again specifically for IMO it should be considered that the range of actors is considerably larger than in mono-model projects and their emphasis may vary to a great extent.

> As mentioned above the key properties of IMO /AD are often intangibles which leads to the conclusion that a combination of CBA and MCA is required to cover IMO and AD in the best possible manner

The following example highlights some of the relevant aspects to be considered:

On an existing link from A to B an additional bus connection is introduced between C and D with the catchment area D having an impact on the catchment area of B (see following figure)

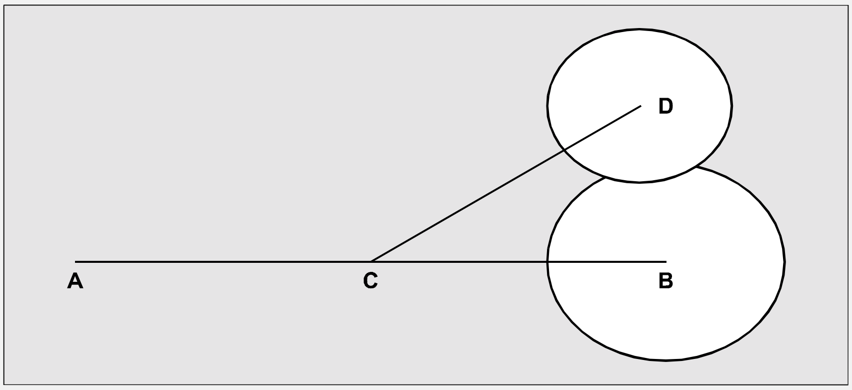

Figure: A simplified example

Regarded properties: operating revenue, jobs and inhabitants accessibility

For the different involved actors the assessment of the measure will be based on varying properties, applying different weights on the various impacts. A small selection could be the following:

For the operator AB it might occur that CB shows a loss in revenue whereas AC shows a gain.

For workers and inhabitants of A the accessibility has improved by the catchment D minus the overlapping of B.

For the local politician the new link is to be promoted because of the improved accessibility. Similar, the users will obtain a choice of travel and their accessibility will also have improved. The bus operator CD will obviously show a gain (either by revenue or with the help of subsidies.) He has two possibilities a) improving interoperability with ACB to gain or to compete and enlarge his catchment area.

The operator AB himself has now two possibilities. a) he accepts the loss CB because of the gain AC and competes himself with CD to win back customers, b) he decides to drop CB and only operate AC.

The decision he makes obviously will have a considerable impact on the accessibility quality of the inhabitants and employees of B and D.

The measure supposed to improve the accessibility might then show a considerable lost for area B.

The evaluator carrying out the overall evaluation surely cannot and will not consider all aspects from the various points of views. However whilst carrying out the process, the quality of the results will improve considerably, if he is aware of the competing, overlapping, and even contradictory effects.

5. CONCLUSIONS

The scope of EUROSIL is the development of **reliable and comprehensive tools** to support decision-making processes with respect to **impacts** of multimodality, intermodality and interoperability on Area Development.

The evaluation process has been developed into a EUROSIL oriented Evaluation Framework, which enables a structured approach to the assessment of IMO impacts on Area Development:

- the Evaluation Criteria Development Process (Stage I),
- Modelling – Measuring – Estimating the Dynamics (Stage II) and
- the Evaluation / Assessment Process (Stage III).

Each stage comprises one or more major steps, which are summarised below:

♦ **Define Objectives and Actors**	**Stage I**
♦ **Identify relevant properties**	**Stage I**
♦ **Identify impacts / indicators**	**Stage I**
♦ **Define Measurement units**	**Stage I**
♦ **Measure / Estimate dynamics**	**Stage II**
♦ **Select evaluation method**	**Stage III**
♦ **Determine measurement type**	**Stage III**
♦ **Assign Values and Weights**	**Stage III**
♦ **Compare alternatives**	**Stage III**

The **Evaluation Criteria Development Process** – Stage I of the Evaluation Framework – combines four steps:

- Definition of the full range of **actors** with an interest in the project and the **objectives** underpinning the project,
- Identification of a set of **properties**, related to the project specific interests and objectives,
- Identification of **impacts** producing the necessary or desired indicators to be considered in the subsequent evaluation process,
- Definition of the indicators in terms of **precise measurement units**.

The **Modelling/Measuring/Estimating Dynamics** – Stage II –- seeks to provide a quantification of the impacts per alternative in terms of changes in indicators. An important aspect of this stage is the emphasis on methods and tools for modelling IMO transport improvements and Area Development aspects as input to decision- making on implementation and investment issues.

The following guidelines are proposed for the modelling framework assessing the Area Development impacts resulting from IMO enhancements:

- An overall modelling framework is required, which includes both land use and transport model components, ideally in a composite structure, which effectively comprises separate land use and transport sub-models with inputs and outputs linked in an overall iterative structure;
- The land use (sub-)model should employ the generalised costs from the transport model in some form, which enables land use impacts to be directly influenced by changes in the transport system, such as improvements in intermodality or interoperability;
- The use of a network-based representation of alternative routes and modes within the transport (sub-)model is considered essential. The network model should employ appropriate multi-pathing algorithms to construct alternative routes through the network between origin-destination pairs;
- The transport (sub-)model should employ some form of choice model, which estimates the demand on each mode **combination**/route based on the generalised costs of the different alternatives;
- The generalised cost formulation used in the transport (sub-) model should include an explicit representation of costs of modal transfer.

As a link between stages II and III it is essential to understand the significance of the magnitude of changes in measured indicators as a result of investments (impacts).

The third stage of the framework deals with the **evaluation / assessment process**:

- The first step is the selection of the appropriate evaluation method. This influences the **measurement types** (e.g. ratio, monetary, ordinal, qualitative, …) that can be used in the evaluation process.
- A further important step of stage III is the assignment of **values and weights** to the evaluation criteria taking into account that these may vary by actor and over time. This is particularly important for IMO projects and Area Development impacts where a wide range of actors are likely to be involved.
- The final major step is the **comparison** of the different alternatives under investigation on the basis of the information analysed as part of the evaluation process.

The use of an appropriate evaluation framework presenting a systematic generation of alternatives, the definitions of objectives and evaluation criteria and the selection of appropriate evaluation techniques will greatly support decision-making in resolving issues of conflicting views on location options, priorities in implementation of plans, IMO enhancements options etc., so that policy makers are able to take account of all performances of planning strategies.

In this context both Cost-Benefit Analyses and Multi-Criteria Analyses can be used in a complementary way, since CBA is bound to monetary values while MCA to qualitative aspects, as well. However, the great number of actors involved in IMO projects and the nature of the properties and impacts describing the effects on the transport system and the Area Development call for case specific selection of evaluation methods.

The monetarising process includes all the disadvantages imbedded in CBA, such as dependence on correct monetarising method, conversion of monetary values in market prices, referencing of alternatives to universal background, etc. This restricts heavily the usefulness of CBA as a sole method in the context of evaluating IMO impacts on Area Development, where a broad range of qualitative attributes is involved. However, when the performance of Cost-Benefit Analysis is legally binding for large public investments there is the need to cover the specific aspects of IMO and Area Development in the monetarising process. If this is not possible these aspects must be covered adequately in the description of the intangibles.

MCA in this respect is able to cope with a wider system of objectives and criteria that could be based on social and economic welfare. The ability of MCA to cope with conflicting views as well (variety of actors!) provides decision-makers with a sound tool for the evaluation of IMO and Area Development.

The EUROSIL **evaluation framework** provides comprehensive guidance as a practical support for decision-makers with respect to evaluation / assessment of Area Development aspects of IMO projects.

Towards this direction the KEP approach supports the person in charge in selecting the “right” properties. The modelling framework provides support for selecting the appropriate models for the assessment of cardinal (quantifiable) evaluation criteria, while for the rest of the properties (qualitative or mixed) a set of appropriate methods has been provided.

The EUROSIL guidelines provide the basis for constructing comprehensive evaluation tools for capturing the added value of IMO and their effects on Area Development. The additional complexity associated with capturing this added value is generally not included within “standard” evaluation tools.

To facilitate an interface between the identification of IMO related properties, indicators and impacts and standard evaluation software (specifically the decision support software package DEFINITE (Janssen and Herwijnen, 1994)), EUROSIL has developed software – called TRANSLATOR – that links the stage I of the evaluation framework with that software package. (Please refer to the public Deliverable 9/10 of EUROSIL for more details. The TRANSLATOR software has been developed in the context of the EUROSIL project and thus held a EUROSIL patent submitted to EC).

We conclude from a pilot exercise to apply elements of the EUROSIL evaluation framework within DEFINITE that there is scope for further user friendly developments of standard valuation software to make this more appropriate to evaluation issues likely to be confronted when considering IMO and their Area Development impacts in the TEN and PEN context.

In cases where the decision-maker / person in charge will not apply a “sophisticated” evaluation but rather a quick assessment of different alternatives, a “manual for simplified property rating” has been constructed (see Deliverable 8 or Annex 7 of Deliverable 9/10). This aims at supporting decision-makers in estimating or assessing the possible effects of IMO on Area Development whenever time, money or experience is lacking.

6. REFERENCES

Batten, D., Kim, T.J., Lundqvist, L. and Mattsson, L.-G. (eds.) (1997), *Network Infrastructure and the Urban Environment: Recent Advances in Land-Use/Transportation Modelling*, Springer Verlag, Berlin/Heidelberg/New York.

Canning D., and Fay L.M. (1993), *The Effect of Transportation Networks on Economic Growth*, Discussion Paper, Columbia University.

Capineri, C. (1996), *From Networks to Regional Development: Representations of Italian Regional Disparities*, Paper presented at the NECTAR Euro-Conference, Mons, Belgium, 24-28 September.

CE DG XVI (1991), Channel Tunnel Study.

CE DG VII (1999a*), Interoperable Modular Pilot Plants Underlying Logistic System in Europe (IMPULSE),* Integrated Task 3.1/2-3.1/3-3-3.2/6-3.2/7.

CE DG VII (1999b), *European Project for Toll Effects and Pricing Strategies* (EUROTOLL), Road Task 7.1/3-7.1/7.

De la Barra, T., Pérez, B. and Vera, N. (1984*), 'TRANUS-J: Putting Large Models into Small Computers*', Environment and Planning B: Planning and Design. 11, 87-101.

De la Barra T. (1989), *Integrated Land Use and Transport Modeling*, Cambridge University Press, Cambridge.

De la Barra T. (1997), *'Improved Logit Formulations for Integrated Land Use, Transport and Environmental Models'*, in Batten, D., Kim, T.J., Lundqvist, L. and Mattsson, L.-G. (eds.), Network Infrastructure and the Urban Environment: Recent Advances in Land-Use/Transportation Modeling, Springer Verlag, Berlin/Heidelberg/New York.

Echenique, M.H., Flowerdew, A.D.J., Hunt, J.D., Mayo, T.R., Skidmore, I.J. and Simmonds, D.C. (1990), *'The MEPLAN Models of Bilbao, Leeds and Dortmund'*, Transport Reviews 10, 309-22.

European Commission, DG VII (1996a), *Transport Research – APAS – Road Transport Evaluation*, Brussels/Luxembourg.

European Commission, DG VII (1996b), *Transport Research – APAS – Strategic Transport: Methodologies for Transport Impact Assessment*, Brussels/Luxembourg.

European Communities (1996), Decision No. 1692/96/CE of the European Parliament and of the Council of 23 July 1996 on the Community Guidelines for the Development of the Trans-European Transport Networks. *Official Journal of the European Communities*, vol. 39, L 228, 9 September 1996, pp. 1-104.

European Commission (1997a), *Cohesion and the Development Challenge Facing the Lagging Regions*, Fourth Cohesion Report, Regional Development Studies, Office for Official Publications of the European Communities, Luxembourg.

EUROSIL Project (1997), *Assessment of the Recent Experience, Deliverable 1*, DG VII, Contract SC-1131.

EUROSIL Project (1997), *Identification of Key Indicators, Deliverable 2*, DG VII, Contract SC-1131.

EUROSIL Project (1998), *Fine-tuning Process of the case studies, Deliverable 4*, DG VII, Contract SC-1131.

EUROSIL Project (1998), *Internal Working Papers* (case study Reports):

- ETC: SILET: Strategic Intermodal Link EuroTunnel
- TRANSMAN SILAH: Strategic Intermodal Link Austria Hungary
- NTUA, SGI, MARIMEX SILC: Strategic Intermodal Link to Caspian Sea
- IVV SILAF: Strategic Intermodal Link Airport and Freight Transport
- IVV SILAP: Strategic Intermodal Link Airport and Passenger Transport
- VTT, SK SILFIR: Strategic Intermodal Link from FInland to Russia
- SK SILBA: Strategic Intermodal Link Barents Euro-Arctic Transport Area
- STRATEC SILUB: Strategic Intermodal Link Urban Area of Brussels
- KRUPP, H/B SILFAS: Strategic Intermodal Link Fast Handling Systems
- SSP, STASA SILUS: Strategic Intermodal Link Urban Area of Stuttgart
- TECNIC SILNOW: Strategic Intermodal Link North-Western Macroregion of Italy
- ATKINS SILIRE: Strategic Intermodal Link Ireland

EUROSIL Project (1999), *Existing Methods for the Strategic Impacts, Deliverable 3*, DG VII, Contract SC-1131.

EUROSIL Project (1999), *Preliminary EUROSIL Concept, Deliverable 5*, DG VII, Contract SC-1131.

EUROSIL Project (1999), *Synthesis and Conclusions on the case studies, Deliverable 6*, DG VII, Contract SC-1131.

EUROSIL Project (1999), *Modelling Multimodality, Intermodality, Interoperability and Area Impacts of Transport Infrastructure, Deliverable 7*, DG VII, Contract SC-1131.

EUROSIL Project (1999), *Elaboration of an Evaluation Framework, Deliverable 8*, DG VII, Contract SC-1131.

EUROSIL Project (1999), *Guidelines for the Appraisal of the Interconnection between Intermodal Transport and Area Development*, DG VII, Contract SC-1131.

Hansen, W.G. (1959), *'How Accessibility Shapes Land-use'*. Journal of the American Institute of Planners 25, 73-76.

Hunt, J.D. and Simmonds, D.C. (1993), *Theory and Application of an Integrated Land-use and Transport Modelling Framework*, Environment and Planning B: Planning and Design 20, 221-44.

Janssen R. and M. van Herwijnen (1994), *DEFINITE: A System to Support DEvisions on a FINITE Set of Alternatives*, User Manual, Kluwer Academic Publishers, The Netherlands.

Johansson, B. (1993), *Infrastructure, Accessibility and Economic Growth*, International Journal of Transport Economics XX, 2,131-156.

Keeble, D., Owens, P.L. and Thompson, C. (1982), *Regional Accessibility and Economic Potential in the European Community*, Regional Studies 16, 419-432.

Linneker B. (1997), *Transport Infrastructure and Regional Economic Development in Europe: A Review of Theoretical and Methodological Approaches*, Report to SASI Project TRP 133, Department of Town and Planning, University of Sheffield.

Mackett, R.L. (1990b), *Comparative Analysis of Modelling Land-use Transport Interaction at the Micro and Macro Levels*, Environment and Planning A. 22, 459-75.

Mackett, R.L. (1991b), *LILT and MEPLAN: A Comparative Analysis of Land-use and Transport Policies for Leeds*, Transport Reviews 11, 131-54.

Nijkamp P. (1981), Multiple Criteria Analysis, Gower, Aldershot.

Pearce, D.W. (1978), The Valuation of Social Cost, Allen&Unwin, London.

Spiekermann, K. and Wegener, M. (1994), *Trans-European Networks and Unequal Accessibility in Europe*, Paper presented at the NECTAR Working Group 3, Workshop 'Infrastructure and Peripheral Regions in Europe' at Molde College, Molde, Norway, 30 September and 1 October 1994.

Spiekermann, K. and Wegener, M. (1996), *Trans-European Networks and Unequal Accessibility in Europe*, European Journal of Regional Development (EUREG) 4/96, 35-42.

Spiekermann, K and Wegener, M. (1998), *Socio-economic and Spatial Impacts of Trans-European Transport Networks: The SASI Project*, Paper submitted for presentation at the 8th World Conference on Transport Research, Antwerp, 12-17 July 1998.

STEMM (1997), *Strategic European Multimodal Modelling*, Project funded by DG XII within the 4th Framework Programme.

Van Delft, A. and P. Nijkamp (1976), *Multiple Criteria Analysis and Rgional Decision-Making*, Martinus Nijhof, The Hague.

Voogd H. (1983), *Multicriteria Evaluation for Urban and Regional Planning*, Pion Ltd, London.

Annex 1: Exhaustive properties list

Abbreviations:

X quantitative
Q qualitative
me measured
mo modelled
es estimated (means neither to measure nor to model)
B Binary (yes / no)
R Ranking (e.g. high, medium, low)
cap general term for number of persons / cars / trucks / tons / containers / installations / ... in total or per time

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
Accessibility (distance)	Distance between new facility and the focus of activities (e.g. DBC or industry)	mo	X	average distance per trip/activity	km
Accessibility (time)	Weighted time between new facility and the focus of the area	mo	X	weighted population/ activity Isochrons	pers/time
Accessibility of services	Regional accessibility to services like security, cultural, education etc	es	Q,X	number of services acc. per time	cap / time
Accidents	Frequency and seriousness of accidents (fatalities, injuries, material damage) e.g. accident costs per tkme	me, mo	X	number and degree of accidents, accident rates	acc/km acc/m km travelled
Authorities, influence by	Influences from/actions by authorities/institutions involved on EU, national level for private/public, passenger/freight transport, e.g. organisation of combined rail - road freight transport	es	Q	–	B, R
Capacity utilisation	Ratio of throughput to maximum capacity.	me, mo	X	degree of maximum capacity in use	%
Capacity, maximum	Maximum amount of passengers/freight per mode and time unit, to be calculated by infrastructure, vehicle capacity and frequency	me, mo	X	maximum amount of passengers/freight/... per mode and time unit	cap
Capital, access to afforded	Availability of banks/investors willing to sufficiently invest in projects	es	Q	–	B, R
Cohesion	Level/intensity of (inter-) regional co-operation and integration e.g. bilateral business	es	Q	–	R
Co-makership opportunities	Possibilities for client and transport logistic services provider to carry out value added actions in terminal environments e.g. joint investments	me	X	revenue and turnover of value added services	EURO/a
Competing terminals	The number/degree of alternatives between competing terminals	me, es	X,Q	number of terminals	cap
Concession, duration of	Period of validity of the grant to operate the infrastructure	me	X	duration of contract	a
Concessions, degree of	Degree of mode specific, existing concessions in the countries, e.g. for exclusive operation of public transport	me	X	volume of specific concessions	no.
Consolidation of freight	Quantities or possibilities for the gathering and splitting of shipments	me, es	X,Q	t/a/region in % of total transport volume	%

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
Convenience (comfort)	Comfort of the terminal for the user	es	Q	–	R
Cost of health, safety and environmental measures	Net costs associated with changes in health, safety and environmental measures (e.g. negative higher basic costs in construction and maintenance, but positive lower costs for society due to the work force suffering fewer accidents)	me	X	costs	EURO/a
Costs of accidents	Direct and indirect costs of accidents	mo	X	costs	EURO/a
Costs of additional/supporting services	Cost of preparation and operating services, such as storage of goods	me	X	costs	EURO/a
Costs of infrastructure	Cost of the essential installations (utilities)	me	X	costs	EURO/a
Costs of labour	Total costs of wages for personnel	me, mo	X	costs	EURO/a
Costs of maintenance (long-term)	Cost of refurbishment and renewal (influenced by frequency and standard of maintenance, quality of construction, accessibility, traffic volume and effect)	mo	X	costs	EURO/a
Costs of maintenance (routine)	Cost of rubbish removal, sweeping, etc., maintenance of lighting, communication and other general infrastructure, accident/damage repair	me, mo	X	costs	EURO/a
Costs of operations	Cost (direct and indirect) of providing the transport or transfer service (e.g. employees and vehicles)	me, mo	X	costs	EURO/a
Costs of superstructure	Cost of the skeletal building	me, mo	X	costs	EURO/a
Costs of traffic effects	Net cost of traffic delays e.g. negative cost of high volumes of traffic, poor organisation, increased traffic management costs and increased maintenance costs at night for working un-social hours; positive costs of mitigating delays by restricting road closures to off-peak hours, diverting traffic, overnight rather than daytime working etc.	mo	X	costs	EURO/a
Costs of use	Costs for passenger/ton per journey (private/public), as they occur for the user	me	X	costs	EURO/a
Cross-docking possibilities	Possibilities for immediate handling of goods, without storage	mo	X	capacity of cross-docking possibilities, handling time/unit	t/a min
Development/ Expansion possibilities	Technical and/or market resources for future expansion	es	Q	–	B, R
Diversions within the network (same mode)	Alternative routes available, considering free capacities	mo	X	amount of free capacity on alternative routes	cap
Diversions within a network (using more than one mode)	Alternative routes available, considering free capacities	mo	X	amount of free capacity on alternative routes/modes	cap
Economic stakes, private regional	The level of private financial involvement	me	X	EURO per total investment costs	EURO
Economic stakes, public regional	The level of public financial involvement	me	X	EURO per total investment costs	EURO

Property	**Description of Property**	**measured modelled estimated**	**quantitative qualitative**	**Indicator**	**e.g. Unit**
Employment effects	Number of newly created jobs (e.g. part-time, full-time, male/female, age structure), direct and indirect influences	me, mo, es	X	employment / unemployment rates	%
Energy consumption	Primary and secondary energy balance, i.e. direct energy consumption (e.g. petrol for usage) and associate consumption (e.g. car production)	mo	X	fuel consumption electricity consump.	l/km joule/km joule/a kWh/a
Environment: direct effects	Effects of infrastructure and operation on water, soil, air, noise, and visual pollution	mo	X	with toxicity weighted pollution, noise	NOx units, dB(A)
Environment: indirect effects	Nuisance values (real and perceived): vandals, drug addicts, homeless, graffiti	me, es	X	damages, expenditures for avoiding measures	EURO/a
Environmental damage (aesthetic)	Levels of visual, tactile, aural, oral and/or olfactory effects, e.g. the disturbance of landscape and cities	es	Q	–	R
Environmental damage (statutory)	Levels of visual, tactile, aural, oral and/or olfactory effect i.e. regulatory features	es	Q	–	R
Equipment	Installations to allow transfer, e.g. telescope-spreader, elevators	es, me	Q,X	– number of installations	R cap
Extension possibilities	Spatial resources for future extension	mo	X	available land	m^2
Financial risks	Level of variability in returns that the investor is willing to accept	me	X	interest rates	%
Geographical location (relative)	Situation with reference to the broad spatial system of which the infrastructure is a part e.g. urban/rural areas, transport networks e.g. average distance	es	Q	–	R
Geographical restrictions	Restrictions, set by topography (height, gradient), geology, water (rivers, coasts) and other physical obstacles	es	Q	–	R
Household density	Indicates urban sprawl e.g. inhabitants per km^2	me, mo	X	inhabitants	Inh./km^2
Industrial effects	Effects on nearby primary, secondary, tertiary and quaternary sectors e.g. change of industrial job density	mo	X	changes in flows of the regional I/O-matrix and inverse employment matrix	GDP, employees
Information systems (real-time) (single mode), availability/location of	Provision of up-to-date information, e.g. via variable message signs	es, me	Q,X	– number of installations	B, R cap
Information systems (real-time) (multimode), availability/location of	Provision of up-to-date information, e.g. via variable message signs	es, me	Q,X	– number of installations	B, R cap
Information systems (static), availability/location of (operator)	Facilities for information supply at terminal, tracking and tracing systems etc.	es, me	Q,X	– number of installations	B, R cap
Information systems (static), availability/location of (user)	Signposts and notice boards for e.g. trips, terminal facilities and their position relative to platforms, operating services and ancillary services	es, me	Q,X	– number of installations	B, R cap

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
Information, background	Access to legal, financial, research and development information, which is of added value for decision making	es	Q	–	B, R
Interchange facilities	Facilities for desired interconnectivity and/or compatibility of modes and operators in a terminal connections to platforms and services in other modes; Maximum transfer times (between platforms, between entrance and platform)	me	X	capacity of interchange facilities, handling time/unit	cap min
Interchange possibilities, intermediate	Spatial and technical changing possibilities along a link, including information systems	me, es	X,Q	number –	cap R
Interchange time	Maximum transfer times (between platforms, between entrance and platform)	me, mo	X	transfer times	min
Investment, duration of	Time scale over which project is to be evaluated	–	X	duration of evaluation period	a
Investment, reliability of	Variance of return on investment	me, mo	X	variance of return on investment	±%
Investment, return on	Expected financial gains in comparison to investment	me, mo	X	return on investment	%
Investment, synergy with others	Level of co-operation/coordinated action with other investments of an investor	es	Q	–	R
Investment, total	Present value (PV) of the net investment	me	X	value of the net investment	EURO
Juridical relationships	The legal framework, e.g. the contracts between investor and owner	es	Q	–	R
Labour market (quality and size)	Type and diversity of skills and labour to be found among the economically active population e.g. average income per GDP	es	Q	–	R
Labour regulations	EU/national/sub-national restrictions on employment/work force	es	Q	–	R
Land use	Effects on the use of developed and peripheral areas in the neighbourhood	es, me	Q,X	– inhabitants	R Inh./km²
Land, value of remaining	Expected change in market value of land surrounding the terminal e.g. differences of land price	me, es	X	land market value	EURO/a
Level of service	A qualitative measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, expressed e.g. in ratio of peak-hour travel-time to max. possible travel-time	es	Q	–	R
Liability	Level of responsibility/legal obligation borne by an actor.	es	Q	–	R
Link, length of	Distance between access and egress of new link	me	X	distance	km
Loading units, standardisation of	Influence on the standardisation process for enabling ease of transfer/handling	me	X	ratio of standardised units/total transhipment	%
Loading units, utilisation of	Utilisation of certain types of loading units (e.g. restriction to containers), expressed e.g. in the ratio of loading units to the total	me	X	ratio of loading units to the total transhipment	%

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
Market demand	Actual and/or potential demand for terminal services, as a result of several aspects like catchment area, market penetration, etc	me, mo, es	X	transport volume	t/a p/a cap
Market fluctuations	Variability of (expected) flows	mo	X	changes of transport volume	±%
Modal split	Proportion of traffic per mode to the total traffic volume	me, mo	X	ratio of the traffic per mode to the total traffic volume	%
Mode split of a journey	Proportion of a journey carried out by each mode used	me, mo	X	ratio of the traffic per mode to the total traffic volume on specific relations	%
Modes, more than one available	Number of transport systems/modes connected to the terminal, in general more than one to allow intermodality	me	X	number of transport systems/modes	no.
Network/Area coverage	Degree of accessibility within an area/network to terminals/links/modes/operator network with access to the terminal link e.g. average distance respectively time	me, mo	X	average distance or time	km, h
Operating facilities (operator)	Access to workshops, vehicle washing facilities, repair facilities	es, me	Q,X	– number of facilities	R cap
Operating facilities (user)	Provision of ticket offices, machines, shelters and waiting rooms	es, me	Q,X	– number of facilities	R cap
Overtaking, possibilities for	E.g. bypass lanes/tracks, overtaking sight distances in sufficient amount and quality to ensure individual travel speed	es, me	Q,X	– number of facilities	B, R cap
Parking location cars long-stay	Proximity and size to facilitate park-and-ride (P+R)	me, mo	X	number of parking lots	cap
Parking location cars short-stay	Proximity and size to facilitate kiss-and-ride (K+R)	me, mo	X	number of parking lots	cap
Parking location taxis	Proximity and size of taxi stand	me	X	number of taxis	cap
Participants, number of	The minimum number of main companies considered to be important in terminal choice	me, es	X	number of companies	cap
Participants, synergy between	Level of co-operation between main companies	es	Q	–	R
Planning, effects of	Opportunities and restrictions as result of policies by local and regional authorities' planning processes	es	Q	–	B, R
Policies	Existence of stimulating or restricting policies on local, regional, national and EU level	es	Q	–	B
Promotion	Marketing activities to increase traffic demand, expressed e.g. in budget for market activities	es, me	Q,X	– budget for marketing activities	R EURO/a
Range of operations	Vehicle range and the distance between service facilities	me	X	average distance between service facilities	km
Recycling of material	Re-use of materials; e.g. avoidance of costs for disposal of large quantities of materials from worn-out pavements	es	Q	–	R
Regulations (legislative)	Regulations on EU, national or sub-national level concerning e.g. transport planning process, compulsory participation of transport planning in land-use planning, co-operation,	es	Q	–	B, R

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
	environmental investigations within the transport planning				
Regulations (operational)	Static and dynamic regulations of speed, weight and size		Q	–	B
Regulations (potential)	Future changes in EU/national/sub-national regulations	es	Q	–	B, R
Regulations (pricing)	EU/national/sub-national restrictions/regulations concerning pricing	es	Q	–	B, R
Reliability, operations	Punctuality of operations, expressed e.g. by the amount of delay-time	me, es	X	degree of delays	%
Reliability, technical	Reliability of fleet, transfer facilities, expressed by e.g. the total amount of breakdowns or the sum of time spent in repair influenced due to breakdowns	me, es	X	breakdown time	h/a
Revenues, direct	Revenues from transport and/or transfer services	me, mo	X	revenues	EURO/a
Revenues, indirect	Revenues from value added services, rents etc	me, mo, es	X	revenues	EURO/a
Safety (network)	Safety of operators and users within the network (active/passive) e.g. accident costs	me	X	see 'accidents' or 'costs of accidents'	
Safety (terminal)	Preventative e.g. internal cleanliness, maintenance of building infrastructure and superstructure, expressed e.g. in costs for preventative measures (video surveillance, etc)	me	X	damages, expenditures for avoiding measures	EURO/a
Security services	Time taken to respond to events by security and emergency services	me	X	reaction time	min
Services provided, ancillary	Size and number of e.g. one-stop shopping, refreshment facilities, toilets	me	X	floor size	m²
Services, support	Type, size and number of utilities (telecommunications, water, electricity, gas, oil), cleaning, building maintenance, security	es	Q	–	R
Skills and Training	Qualification of personnel	es	Q	–	R
Slot allocation	Number of priority slots available e.g. dedicated/non-dedicated slots for specific operators and/or mode	me	X	ratio of priority slots to all slots available	%
Social engagement	Attitude of employees and services providers towards new infrastructure	es	Q	–	R
Speed (network)	Mean speed, determined by the range between min. and max. speed (taking into account the effects of overtaking possibilities)	me, mo	Q	speed	km/h
Stakeholder groups	Unions, ecological groups, local pressure groups, industrial organisations participating in or influencing/blocking decision making	es	Q,X	– additional operational costs	B, R EURO/a
Subsidies, total	Amount of EU/national/sub-national contribution to investment/operating costs	me	X	amount of subsidies	EURO
Taxes	EU/national/sub-national taxes	me	X	taxes tax rates	EURO/a %
Technical harmonisation (operator)	Compatibility between platforms, dimensions of infrastructure, loading units (operator) or uniformity and compatibility of ticketing ,and fares, etc. e.g. number of additional services, extension of use, etc. User	es	Q	–	R
Telematics (infrastructure)	Equipment, necessary to provide telematic services e.g. on-board	es	Q	–	B, R

Property	Description of Property	measured modelled estimated	quantitative qualitative	Indicator	e.g. Unit
	units, road-side equipment, electricity and data interchange technology				
Telematics (services) (same mode)	Availability of transport information provided to improve the level of service	es	Q	–	B, R
Telematics (services) more than one mode)	Availability of transport information provided to improve the level of service	es	Q	–	B, R
Terminal size	Physical dimensions of the terminal	me	X	total building size	m³
Throughput	Actual volume of freight and/or passenger transport per time unit to be calculated by actual infrastructure capacity, vehicle capacity and frequency	me	X	transport volume	t/a p/a cap
Timetabling	Service frequency and destinations	es, me	Q,X	– vehicles / time	R cap
Tolling (infra/super-structure) (operator)	Density per km	s	n	charge	EURO/km
Tolling (infra/super-structure) (user)	Payment procedure (degree of automation); relevant user groups, e.g. time-loss	es	Q	–	R
Tolling (road-use pricing) (operator)	Inter- and intra-urban road use and the percentage of network covered by pricing scheme	me	X	degree of network covered by pricing scheme	%
Tolling (road-use pricing) (user)	Percentage of network covered by pricing scheme	me	X	degree of network covered by pricing scheme	%
Topological location	Position within network(s) assuming a flat plain location within present network, expressed in average absolute inclination	es	Q	–	R
Track management	Amount of control used to manage network e.g. lane closures, variable speed restrictions, overtaking restrictions, ramp metering etc	es	Q	–	R
Traffic demand, expected	Additional traffic demand at development time or during the operation without primary or secondary generated traffic	mo	X	transport volume	t/a p/a
Traffic demand, generated	Additional traffic demand due to generated traffic	mo	X	transport volume	t/a p/a
Traffic volumes and patterns	Passenger and ton-kms (e.g. AADT, peak hour volume), daily/ annual variations of the traffic demand to allow a break down of AADT to e.g. peak hour volumes and vice versa	mo	X	vehicles per time and route	ADT
Transport service providers per mode	Number of operators offering modal and/or intermodal services	me	X	number of operators	no.
Transport vehicle, attractiveness of	Comfort and quality of vehicles for user, e.g. in long distance public transport mainly indicated by average age of the fleet	es	Q	–	R
Transport, limitations and exclusions	Quantity of selected features leading to exclusions (e.g. dangerous goods, max. size of containers, equipment for disabled passengers, vehicle bays)	es	Q	–	R
Travel time	Time of passengers/freight transport between origin and destination on the considered link	me, mo	X	time	h
Trip, duration of	Total duration of trip (h)	me, mo	X	duration of trip	h
Trip, length of	Total length of trip (km)	me, mo	X	length of trip	km

Property	**Description of Property**	**measured modelled estimated**	**quantitative qualitative**	**Indicator**	**e.g. Unit**
Value added services	Services which improve the attractiveness of terminals/links by offering additional value to a product e.g. by information services, service areas	es, me	Q,X	– revenue and turnover of value added services	R EURO/a
Weather influences, long term	Regular or potential variations of e.g. water level, duration of winter conditions, wind speed e.g. the relevant period which influences the traffic situation	es, me	Q,X	– annual time losses because of weather influences	R h/a
Weather influences, short term	Daily/hourly weather changes leading to changes in transport behaviour	es, me	Q,X	– daily time losses because of weather influences	R h/d

Annex 2: Properties affected by IMO related changes and possible Area Development potential impacts

P no.	Property	Explanation	Property Links	Area Accessibility / Quality	"Area Development Potential" Impacts				
					Economic		Environmental		
					Transport Costs	Land Values	Pollution (Air /Noise)	Land Consumption	Quality
SAFETY									
17	Accidents	Frequency and seriousness	45 46	A	Y				
45	Safety Network	Safety of operators/users	46 17	Q	Y				Y
46	Safety (Terminal)	Safe Terminal Environments	45 17	Q	Y				Y
47	Security services	Emergency Services' Response time		Q					Y
NETWORK CAPACITY									
18	Capacity Utilisation	Ratio of throughput to maximum capacity.	All Net. Capacity	A	Y		Y		
3	Capacity, Maximum	Maximum Potential Capacity	All Net. Capacity	A	Y		Y		
68	Competing terminals	Number of Competing Terminals	3 18 19 20 27 28 59	A	Y	Y	Y	Y	
20	Consolidation of freight	Possibilities - Gathering / Splitting of Shipments	3 15 18 19 125/6	A	Y		Y		
22	Cross-docking possibilities	Immediate handling of goods, without storage	3 5 15 18 27 28	A	Y			Y	
24	Diversions/ Alternate Routes	Availability of Alternative Routes	3 15 18 55 98 125/6	A	Y		Y		
5	Equipment (Terminal)	e.g. telescopic-spreader, elevators	3 15 18 22 27	A	Y				
27	Interchange facilities	Terminal for Interchange between Services	14 15 18 22 28 29 68	AQ	Y	Y			Y
28	Interchange intermediate	Interchange facilities (non-terminal)	3 15 18 27 29 68	A	Y	Y			
117	Loading Units standardisation	Standardisation of loading Units	3 15 18 32 125/6	A	Y				
32	Loading units – utilisation	Number / Utilisation of loading units	3 15 18 117	AQ	Y				Y
33	Modal split	Proportion of traffic per mode to total volume	3 15 18 34 35	A	Y		Y		
34	Mode split -journey	No. of modes per journey	3 15 18 33 35	A	Y		Y		
35	Modes Available	Number of modes	3 18 33 34	A	Y		Y	Y	
9/10	Network coverage	Size of Transport Network	3 15 18 41	A	Y	Y		Y	
29	Interchange time	Maximum transfer times	3 18 27 28 62	A	Y				
51	Speed (network)	Average speed	3 18 15 53	A	Y				
61	Travel time (link)	Time on specific link	3 18 62	A	Y	Y	Y		
62	Trip, duration of	Total duration of trip	3 18 54 61 63	A	Y	Y	Y		
63	Trip, length of	Total length of trip (distance)	3 18 62	A	Y		Y	Y	
38	Parking location, cars long stay	Proximity and size to facilitate park-and-ride	3 18 21 37 39	A	Y			Y	Y
39	Parking location, cars short-stay	Proximity and size to facilitate kiss-and-ride	3 18 21 37 38	A	Y			Y	Y
40	Parking, taxis	Proximity and size of rank	3 18 21 37	A				Y	
41	Range of operations	Vehicle range / service facility location	3 9 10 15 18	A	Y		Y		
50	Slot allocation	(Non-)Dedicated slots for operators/modes	3 15 18	A	Y				
14	Terminal size	Terminal Size/Capacity	3 15 18 27	A	Y			Y	

P no.	Property	Explanation	Property Links	Area Accessibility / Quality	“Area Development Potential” Impacts				
					Economic		Environmental		
					Transport Costs	Land Values	Pollution (Air /Noise)	Land Consumption	Quality
15 / 53	Throughput	Volume of freight/ pass. per time unit	Most Net. Capacity	A	Y		Y		
54	Timetabling	Service ODs and frequency	3 15 18 30 62	AQ	Y				Y
56	Track management	Degree network control	3 15 18 55 98	Q	Y				Y
59	Transport Service providers	Number of operators	3 18 35 68	A	Y				
126	Transport Restrictions	(dangerous goods, disabled requirement, container size)	3 15 18 68 102 125	A	Y				Y
	AREA DEVELOPMENT RELATED CAPACITY								
23	Development possibilities	Technical and/or market resources	6 7 9 10 16 113	A		Y		Y	Y
6	Extension possibilities	Spatial resources for future extension	7 9 10 16 23 112/3	A		Y		Y	Y
112	Geographical location (relative)	e.g. urban/rural areas, transport networks	6 9 10 16 23 113	A		Y			Y
7	Geographical restrictions	(topography, geology, river, coast)	6 23 112	A	Y				
113	Household density	Inhabitants per km^2	6 23 112	Q				Y	
16	Topological Location	In network(s) assuming a flat, clear location	6 7 9 10 112	A	Y	Y			Y
	ACTORS								
102	Authorities influence of	Influence of public authorities on transport	68 125 126	AQ	Y	Y	N	N	N
103	Cohesion	Joint/Shared Investment	19 20 68 92	A	Y				
19	Co-makership opportunities	(Inter-)Regional co-operation (business)	20 68 92 103	Q	Y				
100	Labour market, quality and size of	Type and diversity of skills and labour	123	A	Y				
92	Participants, synergy between	Level of co-operation between companies	19 20 68 103	Q	Y				
123	Skills / Training	Personnel Qualifications	100	A	Y				
101	Social engagement	Attitude of employees and service providers		Q					Y
127	Standard of living	Wealth and quality of life of population		Q		Y		Y	Y
	ADDED VALUE								
21	Convenience (Comfort)	Comfort of the terminal for the user	30 37	Q	Y				Y
30	Level of service	(e.g. speed/travel time, frequency, comfort)	21 51 37 62 63	Q	Y				Y
37	Facilities (user)	(e.g. ticket offices, shops)	21 30	AQ	Y				Y
93	Promotion	Marketing activities		AQ					Y
43	Reliability (oper.)	Punctuality of operations	30	Q	Y				
44	Reliability (tech.)	Reliability of fleet, facilities	30	Q	Y				
125	Technical harmonisation	infrastructure, units, vehicles, fares, document	3 8 15 18 20 30 102 126	A	Y				
60	Transport vehicle, attractiveness of	User comfort, quality and age of vehicles	21 30	Q					Y
64	Value added services	Measures to improve the terminals/links/services	21 37	Q					Y
	TELEMATICS								
25	Information system (real time)	Variable message signs, vehicle tracking	8 13 21 37 52 64	AQ	Y		Y		Y
8	Information systems (static)	Tracking (operator) signs, leaflets (user)	13 21 25 37 52 64	AQ	Y				Y

P no.	Property	Explanation	Property Links	Area Accessibility / Quality	"Area Development Potential" Impacts				
					Economic		Environmental		
					Transport Costs	Land Values	Pollution (Air /Noise)	Land Consumption	Quality
13	Telematics (infrastructure)	e.g. on-board units, road-side equipment	8 13 25 52	AQ	Y				Y
52	Telematics (services)	Added value transport information	8 13 21 25 30 37 64 98	AQ	Y				Y
FINANCE									
85	Investment, total	Present value (PV) of the net investment	96	AQ	Y	Y		Y	Y
96	Subsidies, total	e.g. investment/operating	85 102	A	Y				
55	Tolling (infra /super-structure)	Provision of Tolling Infrastructure	3 13 18 24 56 98 102	A	Y		Y	Y	Y
98	Tolling (road-use)	Tolling - operator / user	3 18 24 52 55 56	A	Y				

Annex 3: List of publications, conferences and presentations

Argyrakos G.: EUROSIL Project Presentation, Intermodality Projects Clustering Meeting, European Commission DG VII, Brussels, 17 March 1997.

Argyrakos G.: EUROSIL Project Presentation, 4th Meeting of the Working Party for the Crete Railway Corridor IX, Athens, 27 May 1997.

Duchâteau H. and Lobé P.: "Impacts of Transport Price on Mobility and Land Use in the Brussels Area". TERA Conference, Milano. October 1998.

Giaoutzi M., Grosch N., Serwill D., and Southern A.: "Assessing the Spatial Development Impacts of Intermodality on the Trans-European and Pan-European Transport Networks". European Transport Conference, EU Policy Legislation and Research Stream, Cambridge, September 2000 (forthcoming).

Giaoutzi M. and Stratigea A., "Impact Assessment of Trans-European Networks on Area Development", RSAI World Congress, Session: 'Transport and Communication Networks, Accessibility and Competitiveness', Lugano, May 2000 (forthcoming).

Grosch N.: EUROSIL Project Presentation, TENASSESS Project Final Conference, Vienna, May 1999.

Haag G. Sonderauswertung der Arbeiten der baden-wuerttembergischen Beteiligten im Rahmen des europaeischen Forschungsprojekts EUROSIL (European Strategic Intermodal Links), Stuttgart, Ministry for Environment and Transport Baden-Wuerttemberg (continuing intensive discussions about the results of EUROSIL and its consequences and for Baden-Wuerttemberg).

Haag G. Dynamic Model of Infrastructural Development (presentation of the SILUS case study, together with the project ITEM), Traffic and Granular Flow 99, Stuttgart, Germany (international conference), September 27-29 1999.

Haag G. 12 Seminar für Bürgermeister und kommunale Entscheidungsträger (Mobilitaet, Wirtschaft, Umwelt) (workshop), Stuttgart. Verkehr, Umwelt und städtebauliche Entwicklung - Neue Ansaetze und Methoden fuer die Raumordnung.

Haag G. A comprehensive urban model and its application to the region of Stuttgart (the general framework behind the STASA traffic model and the SILUS case study), 38th Congress of the European Regional Science Association, Vienna (international conference), 8 August-1 September 1998.

Haag G. Stadt der Zukunft, (political inspired discussion about intermodality, multimodality and urban development, key issues of EUROSIL), Wildbad Kreuth, Germany, 25-26th November 1997.

Haag G. Transport and Urban Development: Theory and Application in the Region of Stuttgart (the general framework behind the STASA traffic model, the EUROSIL issues, and

SILUS case study). Self-Organisation, Cognitive Mapping, Urban and Regional Systems and Spatial Information (international conference) Maison Suger, Paris, May 17-18 1998.

Haag G. Modelling of Urban Dynamics and Transport in the Region of Stuttgart (The fundamental issues of EUROSIL), Transport Infrastructure, Space and the Economy NECTAR conference, Tinbergen Institute, Rotterdam, The Netherlands, 23/24 February 1998.

Haag G. Verkehrswissenschaft Physik (the fundamental problems of transport development and land use issues, the EUROSIL project) Bild und Sprache - Modellvorstellungen in den verkehrswissenschaftlichen Diziplinen Ludwigsburg, Germany (national workshop), 26 Maerz 1999.

Haag G. Modelling of Urban Migration and Stock Dynamics - Application to the Region of Stuttgart (The mathematical framework of the EUROSIL case study SILUS), 10th European Colloquium on Quantitative and Theoretical Geography, Rostok, Germany,

Haag G. Presentation of the EUROSIL results for ARTE (television) on 1.7.1999 (The report will be on TV during year 2000).

Lobé P.: "Les impacts de la tarification du transport sur la mobilite et l’amenagement, dans la region de Bruxelles et sa proche peripherie". Le financement de la route, Symposium Internatonal, Paris, 4-6 Novembre 1998.

Lobé P.: "Les instruments publics d’une politique fiscale tarifaire en faveur des transports en commun", Les etats generaux de l’ecologie politique, Bruxelles, B, 25 October 1997

Lobé P.: "Modélisation intégrée Land-use / Transport", La Formation Continue de L’Ecole des Ponts Paris, F, 30 March 1999

Lobé P.: "Impacts of Transport price on Mobility and Land-use in the Brussels area", European transport conference, Cambridge, UK, 11-13 September 2000 (forthcoming).

Segercrantz W.: Presentation in International Transport Conference in Kaunas Lithuania, 15-16.4.1999.

Segercrantz W.: Presentation and short publication: European Strategic Intermodal Corridors (Case. Corridor IX).

Segercrantz W.: Presentation and publication on IV International Conference "Baltic Transit Gateway "99", Riga, Latvia, 27-28.5.1999.

Segercrantz W. "Case studies of European Strategic Intermodal Links".

Segercrantz W.: Article "Case studies of European strategic intermodal links", Nordic Road & Transport Research. No2.99.

Serwill D.: EUROSIL Project Presentation, Project Co-ordinators Annual Meeting, European Commission, Brussels, 17 September 1997.

Serwill D.: EUROSIL Project Presentation, CARISMA Concerted Action 3rd Committee Meeting, Transport Telematics Applications and Services Facilitating Intermodality, Barcelona, 14 October 1999.

Stratigea A. and Giaoutzi M.: "The Role of TEN and PEN in Border Areas", Rivista Geografica Italiana, Special Issue, March 2000 (forthcoming).

Vougioukas M.: "High Speed Rail: European Experience". 'Railways towards 2000 and beyond' International Conference, Hellenic Institute of Transport/Hellenic Railways Organisation/Friends of Railway Society, Volos, Greece, May 1997.

Vougioukas M.: "Competition of Air and High Speed Rail in Europe". 'Air Transport and Airports' International Conference, Hellenic Institute of Transport/Hellenic Ministry of Transport & Communications/Hellenic Civil Aviation Authority/Athens International Airport, Athens, December 1998.

Vougioukas M. and Gilchriest S.: "Monitoring of Traffic and Revenue Forecasts and Spatial Development Impacts of the Channel Tunnel Transport System". European Transport Conference, Applied Transport Modelling Stream, Cambridge, September 2000 (forthcoming).

EUROSIL First Conference/ Workshop, London, 14-15 July 1997, on the themes of:

- *Intermodality in Freight & Passenger Transport*
- *Development of Criteria for Measurement and Evaluation*
- *Modelling in Freight and Passenger Transport*
- *Case Study Methodology*

EUROSIL Final Workshop, Athens, 20-21 September 1999: ***"Assessing the Spatial Development Impacts of Intermodality on the Trans-European and Pan-European Transport Networks"***