THEMATIC SYNTHESIS OF TRANSPORT RESEARCH RESULTS

PAPER 10 OF 10

FREIGHT INTERMODALITY

Issued by:	**The EXTRA project, within the European Community's Transport RTD Programme**
Issue:	**7 (final)**
Disclaimer:	**This paper does not represent the official viewpoint of the European Commission.**

European Commission
Transport RTD Programme
Fourth Framework Programme

Contents

EXECUTIVE SUMMARY

This paper provides a structured guide to the findings and policy implications of research relating to freight intermodality carried out in the Transport RTD Programme[1]. (See Section 1 for advice on how to use the paper.)

Freight transport makes a vital contribution to the economy and society, and is at the heart of globalisation. But its dramatic growth in the road sector is rapidly taking away the benefits, through impacts such as congestion, noise, pollution and infrastructure damage. Innovative policies and technologies can reduce these impacts by promoting the integrated transport chain for door-to-door services. The demand for alternatives to road freight is getting stronger, especially as a result of policy on sustainable mobility, tackled in the thematic paper 1.

The research has two main strands:

- *Quality of transport networks* – requiring improvements in the use and integration of information and communication systems, network infrastructure and the location of terminals, vehicles and standard loading units, and operating procedures.
- *Quality of terminals/transfer points* – requiring advances in terminal organisation and management, terminal access and information management.

In this paper, results are reviewed for "clusters" of research projects in five inter-related areas:

Transfer point efficiency and terminals
To cope with increasing demand and make the intermodal option a competitive alternative to road transport, improved terminal management and the integration of existing telematics systems are required. Research has identified and piloted the most promising technologies, management policies and solutions.
The attractiveness of small and medium sized ports has been enhanced by developing re-engineering tools. Comprehensive tools have been developed to handle information about the merits of potential locations for new intermodal terminals and corridors, suitable for use by multiple stakeholders. Research provided the layout of a new generation of intermodal terminals and the corresponding operational procedures.

Efficiency of networks and freight transport services
The identification and quantification of important service characteristics for both single-mode and intermodal freight transport has shown that a gap exists between the quality of service desired and the quality of service supplied. Studies in this area have provided the basis for European policy development as well as strategic commercial decision-making. Market research found in contrast to the common opinion that intermodal freight transport can be operated cost effectively over shorter distances. Studies identified the mandatory need for further standardisation of containers with respect to intermodal transport.
Several studies tackled the evaluation of the potential of better use of inland waterways and the improved port/ship interface.

Modelling work showed that, under a "current trends" scenario, rail will continue to lose market share to the road sector, falling from 14 to 9%. Research has evaluated a radical strategy aimed at

[1] Part of the Fourth Framework Programme for Community activities in the field of research, technological development and demonstration for the period 1994 to 1998.

overcoming the rail freight deficiencies. A new assignment of routes to different services was devised, based on three sub-networks, a core network strongly dedicated to freight, covering the industrial regions of central Europe, an intermediate network mainly dedicated to freight but also carrying local passenger trains, and a mixed network on which passenger trains would normally have priority.

Transport of goods in and around cities
Intermodal transport nodes – or freight villages – are considered the single most important building block of schemes to provide commercially attractive intermodal services on a European scale. Frameworks and new concepts for freight interchanges on the urban periphery have been developed to reduce inner city congestion and pollution. A key characteristics database of existing European freight platforms has been established leading to the development of a handbook for the guidance and evaluation of new platforms.
Concepts for city logistics have been studied. Estimates of utility values showed that integrated strategies combining infrastructure, information technologies and the provision of door-to-door freight services are the most effective in meeting stakeholder objectives. Demonstrations have been made of two types of innovations, radical changes to logistic processes across a number of shippers or operators and improvements in existing processes.

Information and communication systems
Many projects have been dedicated to develop the opportunities offered by the introduction of new information and communication technologies as the key to seamless intermodal transport. Research was carried out to make intermodal transport more attractive by harmonising information exchange between combined transport operators and their clients. Several approaches showed the internet as the key for easy and cheap access to appropriate information without imposing excessive requirements for new technology or specific systems investment. The introduction of new telematic technologies for improved terminal management was shown successfully. Communication networks have been piloted for the underdeveloped short sea market to improve the waterborne element within intermodal transport. Furthermore an important result was the development of a cargo tracking and tracing box.

Market oriented strategies and socio-economic scenarios
Extensive studies have identified the barriers and negative boundary conditions like costs that operators face in using intermodal transport. Numerous policy recommendations and strategies (modewise and integrated) have been developed to overcome these barriers, to reduce costs, improve communication, standardisation and legislation and to change inappropriate structures. Various case studies have been performed to serve for validation of approaches throughout the great variety of different situations in the Member States and partially Associated States. Several projects prepared decision support tools including intermodal infrastructure investments, guidelines and formed the basis to establish a European transport policy information system (ETIS).

1. INTRODUCTION – HOW TO USE THIS PAPER

This paper provides a structured guide to the results of Research and Technical Development (RTD) projects relating to *freight intermodality*, carried out in the European Community's Transport RTD Programme. It is one of a series of papers:

Paper no.	Theme
1	Sustainable mobility – integrated perspective
2	Sustainable mobility – economic perspective
3	Sustainable mobility – social perspective
4	Sustainable mobility – environmental perspective
5	Urban transport
6	Efficiency and quality
7	Safety and security
8	Human factors
9	Interoperability
10	Freight intermodality

Of the 275 projects financed by the Programme, 52 dealt (partly or fully) with the issues of freight intermodality. Most of these projects were finalised in the year 2000.

How to use this paper:
You are recommended to use this paper to locate RTD results on topics where you have a particular interest, rather than reading the paper from start to finish:

- Start in Section 5 to get an overview of the topics addressed by "clusters" of RTD projects.
- Read the part of Section 6 that summarises the findings for each topic of interest to you.
- Use Annex 1 to identify the individual projects relating to that topic.
- Use Annex 2 to review the key results from each of these projects.

Further details on individual projects can be obtained from their web sites (noted in Annex 2, where available) and from the following Commission web sites:

- http://europa.eu.int/comm/transport/extra/home.html, which includes summaries and the full final reports of individual projects, as well as a variety of analyses and publications prepared by the EXTRA project;
- http://cordis.lu/transport/src/project.htm, which provides the project objectives and summary results as compiled by the RTD project teams.

The other Sections of this paper can help you to gain an overall picture of the interoperability theme, associated policy issues and the objectives for RTD.

The analysis in this paper is the responsibility of the EXTRA project team, and does not represent the official viewpoint of the European Commission.

2. SCOPE OF THE THEME

2.1 Definition of freight intermodality

Intermodal freight transport can be defined as:
"The movement of goods whereby at least two different modes (road, rail, water, air) are used in a door-to-door transport chain".

The European Commission's characterisation of intermodal transport goes beyond earlier definitions that have been put forward by several institutions such as the European Conference of Ministers of Transport (ECMT), which defined intermodal transport as:
"The movement of goods in one and the same loading unit or vehicle which uses successively several modes of transport without handling of the goods themselves in changing modes."

This definition restricts intermodal transport to unitised transport, where the transhipment of goods between vehicles or containers is avoided. However, unitisation is only one possible, though important, means to facilitate the transfer of goods between modes. Thus the ECMT definition appears too restrictive.

'Combined transport' is sometimes identified with intermodal transport. However, it is a specific concept that is included in the overall scope of intermodal transport. It is defined by the ECMT as:
"Intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible."

In order to create a common understanding of the concept of intermodality, the Commission has proposed the following definition:
"Intermodality is a characteristic of a transport system that allows at least two different modes to be used in an integrated manner in a door-to-door transport chain."

It is to be noted that such a definition fits not only with freight but also with traveller intermodality. It also relates to the policy interest in *pan-European networks*, describing a transport system supporting the provision of complete door-to-door services.

2.2 Topics included in the theme

Intermodality is a quality indicator of the level of integration between different modes: more intermodality means more integration and complementarity between modes, which provides scope for more efficient use of the transport system.

The economic basis for intermodality is that transport modes that display favourable economic and operational characteristics individually, can be integrated into a door-to-door transport chain in order to improve the overall efficiency of the transport system. The integration between modes needs to take place at the levels of infrastructure and other hardware (e.g. loading units, vehicles, telecommunications), operations and services, as well as the regulatory conditions.

Freight transport is a *derived* demand. It is part of the economic process – and therefore strongly influenced by such trends as global competition, customised production and the concentration of

supply centres and distribution depots. Freight transport is closely linked with production and distribution processes and is being driven to meet increasing quality requirements in terms of flexibility, speed and reliability.

Taking into account the complex interaction of sourcing, suppliers, manufacturers, retailers and consumers, freight intermodality requires the integration of a broad range of transport services in the supply and distribution chains.

Efficient information and communication flows are vital for the management of these chains. They allow pre- and on-trip information exchange, including service availability, negotiation procedures, tracking and tracing, information on disruptions and the flow of transport documents.

The research topics relating to freight intermodality can be organised in four groups:
- intermodal modelling and planning;
- communication technologies and electronic data exchange;
- handling and intermodal transport equipment;
- access to infrastructure.

2.3 Significance of the theme

An efficient transport system is an essential prerequisite for the European Union's competitiveness. With the projected growth of international trade, the possible extension of the European Union to the Central and Eastern European countries (CEEC) and enhanced co-operation with the Mediterranean countries, the role of transport will become even more important.

Because of growing freight traffic and increasing imbalance in the use of the various modes and infrastructure, the transport system in the European Union is showing signs of inefficiency from a socio-economic point of view. Increasingly, freight transport appears to its citizens as a source of social and environmental costs.

Equally, freight transport itself and the economic growth it supports are being hindered by the road traffic congestion resulting from the increasing use of cars.

The 'business as usual' scenario, based on policies to improve individual modes, is unlikely to be able to cope with future mobility requirements in a sustainable manner. The present approach must, therefore, be changed to an integrated policy framework that takes full account of intermodal options.

Table 1: Evolution of the transport of goods in the European Union (in tonne-km)

	Road	Rail	Inland waterways	Pipelines	Intra-European sea	Total tkm
1970	412	283	103	66	472	1336
1997	1202	237	119	86	1124	2768
Growth	190%	-16%	16%	30%	140%	107%

Source: EU transport in figures, Statistical pocketbook, European Commission, 1999.

Since 1970, European freight transport has increased by more than 100%. Annual growth of about 2% is expected for the next two decades.

Current figures put the costs of traffic congestion at 120 billion Euro or 2% of the European Union GDP. Accidents, air pollution and noise amount to a further 2%. These costs undermine European competitiveness. Further growth in traffic volumes therefore needs to be done in the most efficient way, particularly using those transport modes that can alleviate congestion and reduce environmental impacts.

Table 2: Evolution of modal split in the European Union

	Road	Rail	Inland waterways	Pipelines	Intra-European sea
1970	31%	21%	8%	5%	35%
1997	43%	9%	4%	3%	41%

Evolution of modal split for land transportation only:

	Road	Rail	Inland waterways	Pipelines
1970	48%	33%	12%	8%
1997	73%	14%	7%	5%

Source: EU transport in figures, Statistical pocketbook, European Commission, 1999.

Unless the transport sector focuses on *service* requirements regardless of the mode used, and utilises spare capacities in other modes, road transport is likely to increase further its present market share of 43% (from 31% in 1970). The share of rail transport has decreased since 1970 from 21% to less than 9% in 1997. This decline is likely to continue in the absence of policy action.

The demand for alternatives to road transport is getting stronger. Improved intermodality is therefore critical to the overall efficiency of the freight transport system, since road transport is likely to remain the first choice for the first and last leg of most freight journeys.

Clearly, intermodality is not about forcing a specific modal split. However, by improving the connections between all modes of transport and integrating them into a single system,

intermodality allows better use to be made of rail, inland waterways and short sea shipping, which often, individually, do not allow door-to-door delivery. After that, it is up to the policy-makers to devise pricing policies that encourage mode choice decisions more closely related to external costs.

It is generally perceived that intermodal transport is efficient and cost-effective only for distances above 500 km, in competition with road transport. However, some examples of cost-efficient rail and inland waterways transport operations show that intermodal transport is viable over shorter distances in some circumstances. The success factor for an intermodal transport operation is not only the distance but also the volume and frequency of the service provided.

Although intermodal transport still represents a small part of goods transport – between 2 and 4% – it is increasing rapidly, with an average growth of 10%. In a few important European corridors, intermodal transport can even reach a market share of 30%, when the quality of services meets the needs of users completely. The great success of the intermodal link by inland waterway between the seaport of Rotterdam and the dry port of Duisburg is an example of the effective use of the transport system.

3. POLICY CONTEXT

3.1 Policy objectives related to the theme

Since 1995, the European Commission has taken several steps to promote measures aimed at the increased use of intermodal freight transport.

Task Force on Transport Intermodality

In 1995, the Task Force on Transport Intermodality was launched to stimulate and improve the co-ordination of European research on the topic and to increase industry participation and technology transfer.

The Task Force highlighted some priority directions for research in this sector and promoted high-profile demonstration projects. It was the starting point for further co-ordination of intermodal initiatives to develop a more consistent impact of results on the market. It has fostered a common understanding of the problems and challenges involved in developing intermodal transport in Europe.

Green Paper on Pricing

In December 1995, the Green Paper "Towards Fair and Efficient Pricing in Transport" proposed to stimulate intermodality by implementing more efficient and fair pricing in transport. The Paper also noted that:
"Efforts are needed to complete the internal market in those modes of transport that are generally environmentally friendly and where there is spare capacity. Here increased competition should lead to more competitiveness with respect to road transport."

Pricing is a market-based instrument. It can be used to encourage transport choices that take full account of external costs imposed by the different transport modes. Estimates suggest that over 90% of these costs are related to road transport. External costs of railways and inland waterways are estimated to be only a fraction of the total. Therefore, progress on fair and efficient pricing will be significant in making non-road modes more competitive. At the same time though, this has to be complemented by efforts to complete the internal market in transport, opening up the non-road modes to competition and promoting interoperability across national borders. Together, these policy steps should see a move towards intermodal transport systems in Europe.

Communication on intermodal freight transport

In May 1997, the Commission issued a Communication on intermodal freight transport, setting out actions to promote intermodality. It includes a description of the current friction in the transfer between modes, which is based on the analysis made by the Task Force on Transport Intermodality.

The Communication advocates a systems approach to freight transport, which encourages co-operation between transport modes and favours competition between transport operators.

Examples of proposed new actions are:
- harmonisation of message and document standards;
- establishment of an intermodal freight transport research network;
- development of methodologies for benchmarking performance;

- establishment of a European Intermodal Reference Centre for freight transport;
- promotion of a voluntary intermodal liability regime;
- organisation of Round Tables by Member States.

The Communication particularly noted the need to develop new technologies and applications, especially telematics. It also recognised the need for a network approach to transport infrastructure planning. This has been reflected in the guidelines for the Trans-European Transport Network (TEN-T).

Intermodal transport is seen as important for the integration of the Accession States into the European Union. Freight transport to Central and Eastern Europe has been growing rapidly, and the need to keep some of this traffic off the roads is obvious.

3.2 Policy issues related to the theme

Freight intermodality is an essential component of the Common Transport Policy. In order to provide the necessary impetus to the development of intermodal freight transport, a range of policy issues have been defined:

- The need for an integrated European strategy on infrastructure: trans-European transport networks and nodes.
- Development of the single transport market: harmonisation of regulations and enforcement of competition policy.
- The identification and elimination of barriers to intermodality.
- Implementation of the Information Society in the freight transport sector.

The Commission is also promoting the implementation of intermodal freight transport by a programme of Pilot Actions for Combined Transport (PACT). This programme, launched in 1992, supports operators in launching and publicising innovative commercial services in the field of combined transport (rail, road, inland waterways and short sea shipping), with the aim of encouraging replication in the market. Under the first PACT programme (1992-1996), 66 projects on 33 routes in all Member States were co-financed.

Development of short sea shipping is another area for action at the European level. The Commission has included short sea shipping in the second PACT programme (1997-2001), and proposed supporting policies in a Green Paper on seaports and maritime infrastructure (December 1997).

4. RTD OBJECTIVES

The development and implementation of the Common Transport Policy calls for research to achieve efficient and cost-effective transport networks for goods and passengers. This objective is clearly reflected in the Fourth Framework transport RTD programme, which intends to improve the efficiency of the individual transport modes and speed up their strategic integration into European transport networks.

The aims of the RTD programme are:

- to develop a more efficient, safer and more environmentally friendly transport system for passengers and goods;
- to facilitate the interconnection and interoperability of the separate transport networks;
- to increase the efficiency of each individual mode and improve co-operation between them;
- to promote the design and management of infrastructure with a view to reducing the damage to the environment and improving the quality/price ratio;
- to provide industry, transport operators, users and authorities with the appropriate decision-making instruments based on better knowledge and understanding of mobility, traffic flows, their interactions and interdependencies.

The third objective is clearly relevant to freight intermodality because it aims at creating a framework for optimal integration of different modes.

More specifically, the report of the Task Force on Transport Intermodality proposed to focus future RTD activities on six priority themes, which are major factors in the improvement of intermodal transport in the European Union:

- transfer point efficiency;
- intermodal network efficiency;
- information and communication technologies;
- improvement of transport means and transport equipment;
- market conditions;
- training and market-oriented strategies.

Intermodality does not appear as a separate theme in the content of FP4. Rather, the transport programme includes strategic research into the general functioning of the transport system and specific research relating to the optimisation of individual modes: rail, integrated transport chains, air, urban, waterborne and road. The approach of the research is, therefore, more mode-by-mode than intermodal, but intermodality is a major element of the research sector on integrated transport chains. (In contrast, in the Fifth Framework programme (1998-2002), one whole Key Action is called ‘sustainable mobility and intermodality’.)

In order to strengthen and promote the theme of intermodality, the Council and the European Parliament decided to allocate a supplementary budget of 12 million Euro in December 1997, to fund innovative intermodal transport projects. This action was organised jointly by the transport RTD programme and the transport telematics applications programme.

5. SUMMARY OF RESEARCH CLUSTERS

5.1 Overview

The research on freight intermodality is focused in two main areas:

- *Quality of transport networks:*
  - access to network infrastructure, information and markets;
  - location of terminals for a more efficient network;
  - operations: transport organisation and interoperability;
  - infrastructure, vehicles and standard loading units;
  - use and integration of information and communication systems.
- *Quality of terminals:*
  - terminal access: pre- and end-haulage, terminal connections;
  - operations in terminals: organisation and management;
  - information management.

These two areas have been developed primarily in the 'integrated transport chains' sector of the transport RTD programme. In addition, related projects have been funded in the following research sectors: waterborne transport, strategic research, rail transport, urban transport and road transport.

In this paper, the RTD projects in FP4 contributing to the development of intermodal freight transport are considered within five topic areas or "clusters". These clusters are:

Clusters

Transfer point efficiency and terminals

Efficiency of networks and freight transport services

Transport of goods in and around cities

Information and communication systems

Market-oriented strategies and socio-economic scenarios

5.2 RTD clusters

This Section defines the scope of research in each cluster. More specific objectives are given in Section 6. The titles and objectives of relevant RTD projects are listed in Annex 1, together with a Table identifying the cluster(s) to which each project contributes most strongly.

Transfer point efficiency and terminals

Efficient intermodal transport requires infrastructure planners and managers across Europe to co-operate in establishing coherent networks of efficient transfer points and terminals. Some of these transfer points will become centres of local economic activity, integrating regional supply and demand into the logistics structures and markets for long-distance transport. Research in this area aims to underpin the planning, development and efficient running of such infrastructure.

Efficiency of networks and freight transport services

Research is needed on the optimal integration between transport modes in order to facilitate customer-oriented, door-to-door transport services that draw on the strengths of each mode. A key interest here lies in harmonising the variety of loading units (such as containers of different sizes) to meet common technical and user requirements.

Transport of goods in and around cities

Freight transport in urban areas is now perceived in many European countries as a field where action is required. Freight traffic represents a significant proportion of total urban road traffic, with consequences in terms of congestion, parking, the location and development of activities, and the environment. One solution can be the creation of peripheral logistical "platforms" or freight interchanges, providing intermodal connections that reduce vehicle movements in town centres. Research is helping to identify the conditions under which such platforms can be made to work efficiently.

Information and communication systems

The use of telematics, combining information systems and telecommunications, will improve the feasibility of customer-oriented transport services. In particular, telematics can provide automated interfaces between the ordering of goods, transport management, invoicing and payment. However, open and easy-to-use information systems are essential for the widespread use of these electronic services. Therefore much research has been focused on the piloting of such systems and on the definition of open architectures that can be accessed by all the various players in an intermodal transport service.

Market-oriented strategies and socio-economic scenarios

Sticking to a single transport mode, especially road transport, is common practice for the great majority of transport operators. Research is needed to identify the barriers and opportunities that operators face in using intermodal transport. In addition, work is needed on the conditions for developing a new generation of integrated operators that provide transport services on a door-to-door basis.

Modelling of the drivers of demand for freight transport can help policy-makers develop strategies to improve freight transport and logistics. Similarly, in order to improve the basis for policy-making, statistics are needed on the volume and structure of transport flows. Research has been conducted in both these areas, with a focus on the opportunities for intermodal freight.

6. SYNTHESIS OF FINDINGS FROM COMPLETED PROJECTS

This Section provides a synthesis of the research objectives and main findings from completed projects for each of the RTD clusters defined in Section 5. The key results, policy implications and achievements of individual projects are summarised in Annex 2.

Results from the following projects have been included in the current version of this thematic paper:

Clusters	Sector	Relevant RTD projects
Transfer point efficiency and terminals	*Integrated transport chains*	APRICOT, IMPREND, IMPULSE, PLATFORM, PRECISE IT, TACTICS
	Waterborne transport	EUROBORDER, SPHERE
	Strategic research	EMOLITE
Efficiency of networks and freight transport services	*Integrated transport chains*	OSIRIS, PROMOTIQ, SCANDINET, UTI-NORM
	Waterborne transport	EUDET, IPSI
	Rail	EUFRANET
	Strategic research	WORKFRET
Transport of goods in and around cities	*Integrated transport chains*	FREIA, FV-2000
	Urban transport	LEAN, REFORM
Information and communication systems	*Integrated transport chains*	CESAR, INTRARTIP, ITESIC, OCTOPUS, PISCES, PLATFORM, PRECISE-IT, X-MODALL
	Waterborne transport	3SNET, INFOLOG, MARNET, PROSIT
	Rail	
Market-oriented strategies and socio-economic scenarios	*Waterborne transport*	ASDSS, SHIFTING CARGO
	Strategic research	EUROSIL, INFOSTAT, INFREDAT, MESUDEMO, MINIMISE, SORT-IT, STEMM
	Road	REDEFINE

6.1 Transfer point efficiency and terminals

Research objectives

Objectives in this area are:

- to develop, test and assess improved processes for managing operations and information flows in terminals (ports, airport terminals, rail terminals and their interaction with the road sector) – including the integration of existing management and information systems;
- to develop and test tools for evaluating these improved processes against economic, safety and quality criteria;
- to identify and test actions to integrate all modes into door-to-door transport chains, particularly through the improved management of terminals to meet the needs of the providers of multi-modal transport services;
- to develop and test new technologies for use in terminal areas, such as transfer facilities for palletised goods, rolling stock and telematics equipment;
- to develop and demonstrate a decision support system for evaluating the optimal location of intermodal terminals;
- to demonstrate the use of business process re-engineering in redesigning the operational and organisational processes in small/medium sized ports from scratch;
- to assess the impact of new technology on the port work environment.

Main findings

Increasing efficiency of the road element of the transport chain to and from terminals

One study has looked at ways of improving the efficiency of the initial and final road-based segments of multi-modal journeys, to and from terminals. Interviews showed that the most significant problems were time delays (associated with restricted opening times of terminals, consequent road traffic congestion and the poor punctuality of trains) and a lack of co-operation (e.g. poor exchange of electronic data and a lack of return loads).

The perceived solutions are primarily organisational, based on improved communications and co-operation. However, successful implementation requires win-win benefits to be identified by the actors – in many cases, the road hauliers are not the *direct* customers of a terminal, and therefore receive lower priority than the shippers and railway operators.

Demonstration projects showed that co-operation *between* road hauliers typically fails, due to mutual competition. However, the introduction of round-table meetings of actors *along* the transport chain generated some co-operation. Information and communication technologies appeared to have major potential, but the presence of many small independent road hauliers makes it difficult to get them to participate in a large overall information system unless there is very strong evidence that benefits will outweigh the costs.

Recommendations included policy initiatives to promote:

- co-ordination of opening times at terminals and container depots;
- regular communication and meetings between terminal operators and other actors in the transport chain to identify bottlenecks and efficiency savings at terminals;
- co-operation between shippers, hauliers and intermodal operators to improve planning, data exchange and the organisation of return loads;
- the provision of information infrastructure for data sharing.

Identifying new trimodal transport chains and terminal locations

An appraisal was made of trimodal (waterway, railroad and road) transport chains in order to reduce environmental impacts, in particular for alpine regions along the main traffic corridors to southern and south-eastern Europe in particular

- recommendations for the appropriate location of a desired trimodal freight terminal in Basle/Switzerland in order to reduce external costs compared to Combined Transport, representing the current baseline;
- recommendations to further undertake complex environmental impact assessments aiming at establishing additional multimodal terminals in the middle section of the river Rhine, e.g. at Mainz or Mannheim/Germany, to trigger considerable shifts away from road transport;
- recommendations on how to improve interoperability as a mandatory precondition of trimodal transport chains and terminals, such as integrated terminal designs, advanced design of inland barges, the introduction of common Intermodal Transport Units (ITU), various organisational aspects, and the implementation of efficient information systems.

A framework was defined for a PC based decision support system that provides comprehensive strategic information on the quality and suitability of potential terminal locations. The project

- produced the prototype of a user-friendly software (implemented in MS Access) that consists of a database and a simulation module, comprising the following characteristics
- ranked alternative terminal locations according to weighted values and criteria, along pre-defined classes (cost, flexibility and reliability), attributes (link to the class) and objects,
- achieved flexibility in handling terminal attributes,
- prepared algorithms for solving the rating and ranking based on a fuzzy multiple attribute model,
- provided an interactive and user-friendly interface through wizards that help to define the framework of transportation and criteria, and
- included visualisation and presentation features, such as charts, reports, graphs and maps.

Improved freight terminal management systems

A simulation environment was implemented for the assessment of the impacts produced by different technologies and management policies which can be adopted to enhance the performances of freight intermodal terminals for road-rail transfer.

A preliminary analysis of users requirements has highlighted the following as main features of computer-controlled freight terminals: computer-based booking and dispatch systems for the reservation of transport capacity and for the allocations of loading time and position

- fast loading/unloading devices;
- intelligent gate procedures and automated guidance of trucks to reserved loading places;
- electronic devices to automatically locate and register the ITU (intermodal transport unit) position in the yard;
- computer-aided yard allocation policies.

The adoption of computer-aided management and of new transhipment technologies are the two scenarios that have been simulated in the test site of CEMAT terminal of Verona, “Quadrante Europa”.

While at present forwarders and terminal operators are not co-ordinated and the ITU trips are generally planned only manually, computer-aided management would lead, thanks to automation, to lower service times in the various procedures, from the planning of ITU trips to the

positioning of ITUs on the yard, and to the road and rail gate management. New transhipment technologies for cranes and lifters would allow to reach the maximum terminal capacity.
It has been demonstrated that the adoption of faster transhipment devices without the support of computer-aided management does not produce significant changes in the performances of the terminal.

In many intermodal terminals, additional costs, time delays and quality deficiencies are often due to the wrong positioning of ITUs (Intermodal Transport Units) and to the inefficient management of personnel and vehicles dedicated to the moving of ITUs. One of the prerequisite conditions for improving the overall efficiency of the terminal operations is to have in an automatic way the real-time error-free information about the position of all stocked ITUs and moving vehicles inside the terminal.
GPS integrated with a dead reckoning system gives excellent results all over the stacking area and guarantees the accuracy and availability requirement for the position measurement. The acoustic positioning system is feasible in the real environment even if the accuracy and availability requirements are not completely achieved. On the other hand, the combined use of GPS and acoustic systems, even if from the technical point of view is quite easy to implement, does not increase in significant manner the accuracy and the availability of the automatic location system to justify the costs.
The use of a Position Information Server which takes care of all the operations dealing with the management of position data, allows for a functional separation between the determination of the position information and the management of this information for the purpose of terminal operations (taken care by the operator's information system).

Enhancing attractiveness of small and medium sized ports
Maritime routes can form an effective, rapid and environmentally friendly link within the overall Trans-European Network (TEN). In this framework, many small- and medium-sized ports (SMPs) can play a substantial role as nodes within the TEN, operating both as transhipment and distribution centres.
The principles of "Business Process Re-engineering" were applied to SMPs, in order to eliminate process fragmentation and waste by redesigning from scratch the port processes. To this end, the assumptions underlying the current practices were identified and questioned, and, where necessary, they were dismantled and new assumptions adopted to re-build the process.
The main end-products of the project are the Toolbox for Port Process Re-engineering (PPR), and the Simulation System.
The toolbox includes:

- generic suggestions for re-engineering operation;
- general guidelines for managing the transition period and;
- suggestions for a more effective integration in and adaptation to the framework of small/medium enterprises;
- a set of tools to assist ports in understanding how they should apply PPR and how they can progress it according to their particular operating conditions and business environment.

The Simulation System is a virtual environment where alternative re-engineering scenarios can be tested prior to any actual commitment of strategic funds. The simulator has the potential and the advantage to depict and simulate the operation of any port. It can be customised to such an extent that sea ports, river ports, inland ports and freight centres can be dealt with.

Another project developed improvement scenarios for four case study ports. The scenarios suggest a wide set of changes to raise cost, time and quality competitiveness. All measures, be it

organisational or administrative changes involving investments into technology, infrastructure or equipment, have been collected in a toolbox which can serve as source of inspiration for European ports, port terminals and their customers.
Many of the scenario ideas can be found as "best practice" in the port industry, particularly in the larger ports, but it is likely that these solutions are not implemented in the small to medium size ports.
It was found that the port costs constitute a rather small part of the total generalised costs for a transport from door to door. The quantitative analysis based on generalised costs shows that even if price and time are important, these two factors alone do not explain the choice of a transport solution. The quality of service provided (such as reliability, flexibility and security) is equally or even more important.

A new generation of intermodal terminals is needed

The key infrastructure requirements for integrated terminals were analysed , the current rolling stock used by major European railways, the potential of short to medium distance freight markets which can be attracted from current road flows, the operational procedures for the rail part of Intermodal Transport Chains (ITC) and related technical transhipment systems, such as portal cranes. A project dealing with integrated terminals

- promoted optimised terminal layouts, improved operational procedures, and the use of advanced Terminal Management Systems (TMS);
- performed a survey of current GPS-based Identification, Location and Positioning systems (ILP) and systems already in development;
- defined and tested new features of automated freight handling by performing practical tests at intermodal terminal in Padova (Italy), in Noisy-le-Sec (France), and at the Krupp Fast Handling System in Duisburg-Rheinhausen (Germany);
- defined, designed and constructed prototypes of new wagons suited for automated operation, and in particular the efficient handling of Intermodal Transport Units (ITUs), which have been tested in loading/unloading campaigns at intermodal terminals;
- assessed working conditions and safety regulations at automated intermodal terminals;
- analysed technical and organisational aspects of intermodal terminals and their impact on ITCs;
- developed simulation models for full scale scenarios, based on the field trials, namely:
- the so-called 'Micro Model' consisting of an expert system and a simulation module allowing to evaluate different terminal designs and to validate the operational efficiency and quality respectively,
- a 'Macro Model' for analysis of multimodal network efficiency and attractiveness on a pan-European level; and
- formulated recommendations on the functional layout of future intermodal freight terminals, recommendations for the optimised design and operation of rolling stock, and recommendations for procedures addressing different shipment distances.

Standardised and automated intermodal transfer of palletised goods

Despite the established use of pallets in European transport and distribution networks, the lack of international standardisation has limited exploitation of integrated pallet distribution systems. The European pallet population has as many non-standardised pallets as standard ones, and most loading interfaces are not compatible with standard pallets formats.

It was shown by research, analysis and demonstration that loading bay and intermodal transfer of palletised goods can be fully automated, electronically tagged, tracked, managed and networked within existing intermodal transport systems.
The participating companies have proved the viability of transferring palletised goods in an uninterrupted recyclable intermodal distribution chain. The system is based on three key products:

- standard (ISO-conformed Europallets) or customised pallets,
- radio tagging and read/write devices,
- three Automatic Loading Units (named SHOTGUN, MAGNUM and EXCALIBUR) for transferring vehicle loads of palletised goods. The MAGNUM ALU has been identified as the most versatile solution.

6.2 Efficiency of networks and freight transport services

Research objectives

Objectives in this area are:

- to develop and standardise technologies for the intermodal transfer of goods;
- to identify and evaluate strategic options for the development of multi-modal freight links, such as a trans-European rail freight network and shipping on the Danube;
- to provide decision support for the development of economic regions with excellent intermodal connections and supporting logistics;
- to evaluate the potential for improving intermodal door-to-door transport services, and the consequent effects on working practices.

Main findings

Improving intermodal door-to-door services and boundary conditions

One broad-ranging study has analysed opportunities for new intermodal door-to-door services, and barriers to these services, for each of six promising market segments:

- rail traction;
- short distance (<300km) intermodal transport;
- small shipments in intermodal transport;
- segments where quality (speed, reliability etc.) is at a premium;
- integration of air transport into multi-modal chains;
- short sea shipping.

An Action Plan has been devised, recommending policy changes at European and Member State levels to promote intermodal transport in each of the six segments. Priorities were proposed to be:

- early moves towards the fair and efficient pricing regimes already proposed by the EC (e.g. for track access and terminal use);
- establishing a pan-European regulator for intermodal transport (with the task of harmonising market liberalisation and access to infrastructure in the EU Member States);
- encouraging public-private partnerships along the transport chain, particularly involving door-to-door shippers;
- providing limited subsidies for new and improved intermodal infrastructure;

- establishing and promoting standards (e.g. for loading units, electronic data interchange and harmonised procedures/documentation at transhipment points and border crossings);
- allocating further funding to research and development, particularly concerning information systems and technologies for faster transhipment;
- continuing the EC PACT programme for pilot actions in combined transport, with specific targeting of the most promising market segments;
- organising roundtable meetings between stakeholders in each Member State, tasked to identify and remove barriers to intermodality.

Specific recommendations for individual market segments were:
- to ensure full and uniform liberalisation of rail track access across all Member States;
- to set up a fair and open system under which different operators can bid for capacity (railway slot allocation);
- to ensure adequate priority is given to freight trains (in competition with passenger services), by setting up rules or establishing freight freeways;
- to improve the quality and capacity of rail links, and add rail links to major airports;
- to promote short sea shipping and improve its quality (e.g. through harmonisation of opening hours, operating procedures and equipment).

Another study reviewed and analysed 'working cultures', and organisational and management structures in current European (intermodal) freight transport;
- identified and assessed the impacts of new technologies in freight transport on the number of employed workers, their working conditions, the quality of jobs (e.g. a shift to more high skill jobs), the time pressure dictated by efficiency considerations and the membership to trade unions;
- highlighted new logistics and production systems – with respect to reliability, integration, flexibility and cost reduction – and their impacts on the initially defined working cultures;
- produced a ranking of ten key issues in the development of freight transport systems;
- analysed five national case studies for the implementation of specific technological and/or organisational developments;
- identified twelve policy areas addressing the barriers faced by intermodal developments, namely: the size of the freight sector work force, labour regulations, payment; social security, education and training, health and work safety, recruiting, organisational structures, behavioural codes, bargaining, employee and trade union involvement, and the general promotion of intermodal transport;

derived a set of ten policy suggestions based on identified problem areas and policy fields.

Intermodal transport attractive for short and medium distances

In another study focused on rail/ship connections, market research found that, in contrast to a widely held opinion regarding critical distances, intermodal freight transport by rail can be operated cost-effectively over distances shorter than 500 km if the volumes and frequency are high enough. Private regional railway companies could be successful over distances up to 100 km near major ports.

A simulation tool was developed to support freight operators in optimising rail-based services around ports. For example, a new and efficient solution was identified for seaport-hinterland connections, based on the following configuration of rail services:

- seaport container shuttles, bundling container transport flows from different quay sites of one seaport in order to dispatch them towards a dry port;
- long-distance trains between the dry port and a hub in the hinterland;
- short-distance shuttles, providing rail feeder services to/from hinterland destinations.

Similarly, another specialised study demonstrated the commercial viability of creating intermodal transport services in peripheral areas (such as the Nordic countries) and over short distances. An analysis of freight flows revealed a number of factors that are important to the success of intermodal freight transport between the Nordic countries and continental Europe:

- reasonable track charges;
- a fair railway slot practice;
- consolidation of flows into fewer terminals and corridors like continental freight freeways;
- quality of information through the different phases of the transport chain;
- closer co-operation between intermodal operators.

As transport from the Nordic countries to continental Europe is heavily dependent on a sea leg, port terminals should be considered in policy actions to promote intermodal transport. Currently, no port in the Baltic Sea operates a full-sized intermodal terminal that is able to handle complete block trains.

Efficient rail freight

A project identified and evaluated conditions for the development of a trans-European rail network mainly dedicated to freight transportation and to establish a strategy for its implementation.

An initial market survey showed that the majority of shippers interviewed are satisfied with domestic rail transport, but regard the quality of international rail transport as inadequate. Main criticisms included poor flexibility and reliability, a lack of co-ordination between operators, inadequate information, high costs, unreliable pricing policies, and a failure to co-operate in exploiting logistical systems.

The development of demand was modelled for freight transport in 2020. Under a "current trends" scenario, rail would continue to lose market share to the road sector, falling from 14 to 9%. By combining the demand model with a model of the railway network, the project then evaluated the potential effects of changes in rail infrastructure and operations. A new assignment of routes to different services was devised, based on three sub-networks:

- a core network strongly dedicated to freight, covering the industrial regions of central Europe;
- an intermediate network mainly dedicated to freight but also carrying local passenger trains;
- a mixed network on which passenger trains would normally have priority.

The modelling results indicated that traffic on the dedicated network could increase significantly, accounting for 85% of total freight traffic on just 20% of the rail network. Journey times on this network could be cut by 20 to 30%. The decline in modal share of rail could be reversed, taking the share back up to 16%. Gains in national markets would be of the same order of magnitude as gains in international transport, though varying between Member States.

Rediscovering inland waterways

A project provided a comprehensive evaluation of the Danube waterway by identifying preconditions and measures that will turn the Danube into a key transport infrastructure for East-West-European transport flows on the South-East axis.

The project:

- performed an in-depth analysis of existing waterway infrastructures on the Danube river and adjacent canals, with respect to
- navigable conditions per river/canal section,
- transport capacity per section, depending on waterway width and depth, the capacity of locks, and headroom below bridges,
- existing ports, their facilities, typical goods and capacities;
- analysed inland ship fleets – i.e. fleet structures and their capacity – per country, design aspects in ship and transhipment technology, existing shipyards, and infrastructure bottlenecks related to the interaction of ports and current fleets;
- has analysed the prevailing transport market conditions in the Danube corridor, e.g.
- recent economic developments in bordering states,
- the current structure of transport markets per country,
- the inland navigation market compared to the rail sector,
- Danube river to sea connections, especially to North Sea and Mediterranean sea ports, with a focus on multi-modal services;
- performed an analysis of trade and transport flows in the Danube region;
- forecast future trade flows based on developed scenarios for the Danube corridor;
- analysed and modelled potential transport volume and summarised the waterway's potential on a per country basis; and
- elaborated recommendations for initiatives aiming to improve the Danube's competitiveness, by identifying needs for investment and schemes for market restructuring.

Improving the port/ship interface

To create effective alternatives to long-distance road freight traffic, the intermodal chain that uses waterborne transport as a major component must be competitive. Since cargo must be transferred between ships/barges and land transport modes (trucks or trains) at least twice, the efficiency of the port/ship interface is of vital importance to attaining such competitiveness. A study developed new concepts for efficient port/ship interfaces in order to make Short Sea Shipping (SSS) the best choice for as large a share as possible of the total transport distance. The project took into account both intermodal SSS terminals and vessels.

As for terminals, the focus was on the cargo handling system. The system is able to handle the most widely used cargo containment units and uses Automatically Guided Vehicles (AGVs), assembled into sets of several carriages and designed to fit under the cargo cassettes standard on the market today. Trailers can be handled using tug-masters and trailer horses. Two designs have been developed for the terminal ramp system: the first is a fixed two-level land ramp; the second is a two-level link span to be used for large variations between high and low water.

The project distinguishes ships and barges. Ships are characterised by a mono-hull with two or three decks, full-width stern ramps, straight deck lanes separated by curbs, automatic lashing devices, and simultaneous access to main and weather deck by AGVs and tug-masters. Barges are characterised by full-width RoRo bow ramps, one or two decks, straight deck lanes separated by curbs.

New standards needed

A study surveyed current container standards related to intermodal transport, as well as the role of non-standardised loading units, used in European container shipments and in particular

- has elaborated recommendations to standardise a future European loading unit with the main dimensions of current standard swap bodies, and to include stackability, top corner fittings and certain additional strength requirements to the design;
- specified a standardised future European loading unit that will be suited for all current European transport modes, by
- providing two sizes for road transport (rigid truck and semi-trailer) with optimised height to make best use of the maximum allowed overall vehicle height of 4,000 mm, light weight to avoid tare penalties and rather cheap to produce,
- providing a rail transport unit utilising the maximum clearance of corridors, and loading patterns available with the majority of the current European rail wagon fleet,
- providing a unit for inland waterway transport, designed to be stacked at least four elements high, and considering the problems of cellular ships to carry different size loading units, because they are mainly designed to accommodate ISO containers.

6.3 Transport of goods in and around cities

Research objectives

Objectives in this area are:

- to provide guidance on establishing commercially viable links between small/medium-sized enterprises and freight villages, their services, procedures and information systems;
- to evaluate freight village structure and layout in order to determine the opportunities and limits for improving freight villages to enhance intermodal transport competitiveness;
- to develop and demonstrate new concepts to distribute and collect goods in urban areas;
- to provide guidelines and criteria for designing, locating and organising freight platforms in urban areas.

Main findings

Establishing new freight platforms and villages

Freight platforms or villages are transhipment areas where many transport companies (such as forwarders and logistic service providers) are located, and ideally where at least two transport modes are connected. A database of 96 European freight platforms has been created, identifying key characteristics such as financial arrangements. In addition, a handbook has been developed for local authorities and transport sector companies. The handbook provides guidance on establishing new freight platforms. Topics include:

- financial and organisational issues, and their impact on the efficiency of platform operations;
- the impact of technology, equipment and design on platform efficiency;
- evaluation of potential impacts on urban traffic and the environment.

The handbook does not replace a detailed analysis of the regional characteristics, which is essential for the optimal design of freight platforms. Rather, it provides a structured framework of how to plan platforms according to the specific regional issues. For example, computer simulation showed that the introduction of freight platforms has different levels of benefit depending on the city context. Truck mileage may be reduced by 40%, or even increased.

The role of local authorities, guided by the handbook, would include the provision of:

- suitable sites;
- appropriate regulations;
- transport infrastructure;
- subsidies for other infrastructure, such as the establishment of bimodal transhipment terminals.

Another project analysed and evaluated freight village structures and layouts in order to determine whether the proximity of different transport and logistics activities is a key factor for the use of intermodal transport. The project:

- performed case studies in seven European countries covering a total of 14 freight villages (FV) representing two principal models, i.e. integrated FVs and non-integrated FVs, whereby the latter type does not allow for a change of transport mode at the terminal;
- carried out some 130 interviews with FV managers, logistics and transport providers, and public authorities involved with planning and developing freight terminals;
- found major benefits for regional economic development where integrated freight villages have emerged, owed to improved intermodality, the availability of attractive services, and the proximity of different transport and logistics activities at one site;
- assessed the environmental impacts of FV operation with particular respect to dangerous goods; from this assessment three management tools emerged
- a Good Practice Code, in the form of a user-friendly handbook (available via the internet or on CD-ROM), addressing transport and storage operations in FV areas,
- a Decision Support System (DSS), that has been field-tested by three FVs, meant to help assess the risks connected to handling of dangerous and flammable goods; this DSS builds on a database of some 160 substances and materials, and
- a Training Software Tool (again available via the internet or on CD-ROM) comprising technical guidelines for operators, and providing recommendations on communication, organisational matters, professional skills and related training of staff, ultimately promoting the implementation of an environmental management system in FVs.

Innovative city distribution concepts

Concepts for city logistics were studied in abstract and with reference to approaches being considered in eight cities (Seville and Cordoba, Spain; Norwich, UK; Vienna, Wiener Neustadt and Linz, Austria; Regensburg and Halle, Germany). Estimates of utility value showed that integrated strategies combining infrastructure, information technologies and the provision of door-to-door freight services are the most effective in meeting stakeholder objectives. In Vienna, the introduction of a city freight terminal was estimated to offer a cost saving of 10% to freight service providers.

Two concepts were developed in greater detail – load zone management and electronic logistic management.

Load zone management is a system for automatic reservation of space in a city centre zone for loading and unloading lorries, supported by stricter enforcement of regulations to prevent illegal parking by private cars in that zone. It aims to reduce traffic jams due to parked cars and lorries blocking the street. A system was designed based on Internet access, making it available to a wide range of users without them needing special software. Messages would be transferred from the central reservations system to a display panel at the loading zone via the mobile phone network.

A logistic management system provides a basic structure for electronic data processing from source to destination along a logistic chain, to facilitate integrated planning, monitoring and control of the movement of goods. This can support the consolidation of goods into fewer vehicles. A prototype system was developed, tailored to the needs of a logistic service provider. The system was shown to manage the required tasks with full functionality.

Broader access for SMEs

Market feedback has shown that intermodal transport is increasingly considered by small and medium-sized enterprises (SMEs) to be a viable option. Many SMEs require logistic and information services, which can be located in freight villages. Therefore general guidelines have been developed for the implementation of freight village information systems relevant to SMEs, and a demonstration system provided on the Web. A classification system was also recommended, identifying freight villages according to the services and facilities provided, in order to support market access.

The research recommended specific actions to prepare SMEs for the substantial changes they have to face in using intermodal transport. These policy actions could include education, training and information on market developments, as well as support for new technologies providing easy access to information services.

6.4 Information and communication systems

Research objectives

Objectives in this area are:

- to develop and demonstrate frameworks, standards and interfaces for information exchange between all the actors along an intermodal transport chain, while respecting issues of confidentiality, cost and the efficient use of existing information systems;
- to develop and demonstrate (networked) information services to support all parties along door-to-door transport chains, often focused on specific market sectors such as international rail freight and short sea shipping;
- to develop and demonstrate systems to increase the efficiency of intermodal terminal operations;
- to develop a telematics-based brokerage for matching transport demand and supply
- to evaluate specific telematics technologies, such as the integration of tracking and tracing systems within a seamless consignment management structure, and the automatic location of containers and vehicles inside terminal areas;
- to develop decision tools for the design and operation of intermodal transport services;
- to determine the basis of an overall European RTD strategy to develop logistics applications.

Main findings

Better information for customers

Combined Transport (CT) operation procedures require the establishment of a seamless information chain. The information exchange in intermodal transport is characterised by a number of diverse modalities each with own terminology and regulatory framework, and by a complex network of small and large organisations each with its own culture, organisation and degree of automation. A wide variety of communication flows already exist between CT

operators and their clients and many of them adopt such modern technologies as computer-generated fax transmission, e-mail, and electronic data interchange.

Research was carried out to make intermodal transport more attractive by harmonising information exchange between CT operators and their clients. One project demonstrated how different systems can be virtually interconnected and offered standard client interfaces to the customers.
The main outcome is a pilot system for communication between CT operators and their clients. The system provides clients with the opportunity to book transportation services, and to get information about the status of their loading units directly via the Internet, without any specific programs installed on their PCs. Status information is stored in a central database which is continuously updated by project partners, while a booking interface allows clients to contact CT operators directly.
The different data exchanged between CT operators and their clients have been organised in accordance with the EDIFACT standardised message structure, in order to facilitate direct electronic data interchange. Strict access rules to common information are defined, since CT operators participating may be competitors.

Another project designed and tested an open, globally accessible and comprehensive set of information services able to support the pre-contract stage of the intermodal transport. Market information useful for organising the delivery of cargo and for setting bookings, trade agreements and contracts is included, as well as information including infrastructure capabilities, routes, facilities, timetables, tariffs, reliability of delivery.
The project has provided a conceptual definition of the full information network and, based on this definition, a working prototype in which a representative portion of the network services has been implemented to demonstrate the full network feasibility.
A survey of user requirements has resulted in a consistent and Europe widely validated list of user requirements and associated constraints for the information platform. Services have been grouped into three categories:

- information platform services, providing a one-stop-shop for information on transport services available,
- real time services providing capabilities for booking and ordering transport services and getting immediate confirmation, and
- support services providing monitoring information on cargo delivery.

The project has developed a data model, integrating all information relevant to pre-contract intermodal or point-to-point transport. The system has been tested in four pilots envisaging different coverage domains.

Another project developed a prototype version of a system, able to provide real-time information to interested parties via the World Wide Web, without imposing excessive requirements for new technology, information disclosure or additional information management. The system is an Internet-based track and trace logistics system communicating to external systems using Electronic Data Interchange and E-mail technology. The system gives access to an Oracle database, where data about goods being moved are stored.
The system is provided with a scheduling component that is fed from a database to produce possible routing, minimising distances and costs. In particular, it deals with the Triangulation Problem, a Vehicle Routing Problem with Time Windows, multi-port and multi-depot, handling

side-constraints, suggesting intermodal transport alternatives, and providing a rescheduling facility.

A project established the prototype of a centralised, web-based communication node, that allows to handle inhomogeneous information from various sources in a complex shipment process; in particular the activity

- connected and integrated several transport modes (i.e. rail, railway and waterborne), logistic providers, forwarders, agents and depots into a main 'umbrella' module, successfully improving information flow, trackability and reliability of short to medium distance shipments;
- successfully demonstrated and customised the Internet based concept with the players and users in the existing medium haul corridors:
- Valencia – Madrid, comprising a maritime leg with incoming and outgoing cargo to the port of Valencia, a connection to the railway services to and from Madrid, and road transport to and from the Madrid terminal to final destinations, and
- Marseilles – Lyon, comprising a maritime leg to and from the port of Marseilles, a connection with inland waterways services and road transport to and from the Lyon station to final destinations;
- additionally validated the benefits of the concept using a 'Virtual Intermodal Chain Simulator', which yielded an overall positive resonance to the chosen approach.

To solve current communication problems during cargo tracing, a project designed, tested and validated a common and open distributed information and communication platform for adaptive tracing of communication chains and tracking of general cargo through all sections of the logistic chain. Such a platform allows all relevant partners in the transport chain to log on to the system and still use their own existing software and hardware.
The platform contains two technical layers:

- a tracing and communication e-mail-based system to process and communicate information to partners;
- a tracking and identification system for gathering information related to physical cargo operations.

Both layers were tested and validated at different test sites for two cargo products: forest products and general cargo. The focus was on the integration of small, flexible in-land terminals that can benefit from the adaptive cargo tracing servers.

An integrated information system approach was created by another project that manages transport demand, the supply side, the optimal use of infrastructure and all of the networked assets used. The project proposed a timeline for gradual implementation of market driven changes for the short-term (next 18 months), mid-term (12 to 42 months) and long term (36 to 66 months), that would include software developments, organisational measures, and the gradual intro-duction of improved hardware into the road and rail sectors. These time scales are possible only if all parties constructively assist and endorse the changes necessary, so that Europe can have the quality of freight services it urgently requires within the next decade and beyond. At the same time, manufacturing and logistics will need progressively to assimilate these enhancements to freight transportation and react accordingly, so that the transportation linking distributed manufacturing activities becomes truly and transparently integrated within the supply chain itself.

A further project developed, tested and evaluated a Transport Chain Management System (TCMS), a prototype software tool for information and communication management. The TCMS

is designed to assist the transport manager in handling the variety of players, restrictions and options characterising intermodal transport solutions. The modular structure of the TCMS makes it generic enough to be used from simple transport supervision to automatic message handling in complex logistics solutions. It can be adapted stepwise to handle more difficult transport chains with an increasing number of functions gradually integrating the complete workflow of transport chain management from stock control and transport service quotations to invoicing. The modular structure gives the TCMS a market potential both as a complete system or as separate units.

Two projects improved the freight terminal management systems using new telematic technologies.

Communication networks for short sea shipping

Within the freight industry, the short sea market is still at an early stage in the usage of electronic booking systems, whereas in the deep sea market most of the larger players have their own web sites and booking systems developed. The project completed a demonstrator schedule display and cargo booking system for the short sea market within Europe.

A product was developed which can be integrated in the logistics market place once short sea trade will have fully incorporated new communications systems, and in particular the Internet, into commercial activities. It can be used for both feeder and door-to-door operations as well as having the ability to handle intermodal connections. The system is designed to improve access to short sea shipping and intermodal services and provides a simple cost-effective booking system that is immediately available.

Benefits for the shippers include:

- ability to compare competing schedules,
- ability to automatically make connections between sea-sea or sea-intermodal services, thus extending the supply chain information available,
- zero cost at the point of delivery.

Benefits for the lines include:

- a large market can be potentially reached thus increasing awareness of short sea shipping opportunities,
- co-operative opportunities can be highlighted between lines to exploit new routes.

Another project developed an operating prototype of a real-time logistics information network for multimodal transport operators in different regions. The network provides open and globally accessible information services with the aim to enhance the competitiveness of the European and Mediterranean maritime ports. Analysis is focused on ten services considered the most interesting by transport operators and port authorities:

- The “EU port single desk management service” proposes a harmonised and common interface for document submission;
- The “unified dangerous goods service” creates unified procedures for electronically submitting dangerous goods notifications;
- The “ship tracing service” provides the current position and route for vessels;
- The “manifest interchange service” allows users to enter manifest information, and generate manifest data in a standard format;
- The “commercial information interchange service” allows agents—shipping lines, logistics operators, shipping agents, etc.—to offer their services via html pages;
- The “port consultation service” provides information about ports and terminals characteristics and their operative situation;

- The "statistics interchange service" collects information on goods and passengers transported and data on the movement of vessels for each port;
- The "Port Cargo Community System in a small port" provides services dedicated to information processing and interchange for small-sized ports;
- The "manifest short sea shipping service" sets up the exchange of short sea manifests between North and South European ports;
- The "exchange interport service" provides interport communications.

The potential of these services has been evaluated by a SWOT (Strengths Weaknesses Opportunities and Threats) analysis.

A further project applied an Interconnectivity Manager (IM) provided by other activities. It developed and tested a new tool, named ProShip, which uses the IM for information exchange with customers or transport industry. The ProShip tool is able to support:

- the brokerage between the demand and the supply side, including the pre-calculations of alternatives and the administration of receiving commitments or orders;
- the comparison between agreed and planned transport and reality, including information on performance, control of deviations and automated transfer of information to the customer.

The products have been studied in four scenarios which were established according to different transport relations and structuring of the organisation regarding the use of information technology. Installations and pilot usage of the ProShip tool include:

- shipping price request in the Rhine-North Sea scenario,
- business negotiation process, including booking by the customer and confirming the booking by the operator, in the Mediterranean scenario,
- matching empty capacity and cargo in the Finland-Rhine scenario,
- satellite-based tracking and tracing of cargo, in order to obtain information on the estimated time of arrival and current status of the transport in the Rhine-North Sea and in the Finland-Rhine scenarios; visualisation of cargo positions and vessel movements has been assessed as a major success of the project pilots;
- dangerous cargo management, including announcing, verifying and administering information, in the Baltic scenario.

6.5 Market-oriented strategies and socio-economic scenarios

Research objectives

Objectives in this area are:

- to identify specific measures to promote the interoperability and economic efficiency of the trans-European transport system, such as the optimal balance between market competition and transport regulation;
- to evaluate the competitiveness of specific modes, such as the European container shipping industry; high-speed sea freight ferry services and inland waterways;
- to develop methodologies for establishing European transport databases and collecting the intermodal freight transport data required for strategic transport planning at a European level;
- to model the factors affecting the increased demand for road freight transport and the way these factors relate to changes in industrial processes and logistics;

- to develop guidelines and tools for analysing modal split and route choice for freight transport, as a tool for policy-making on intermodality.

Main findings

Eliminating barriers and changing structures

Policy recommendations to overcome obstacles to intermodality have been made for seven (trans-European) transport applications. These included:

- for parcel services, further liberalisation of the letter market, simplification of border crossing procedures, and abolition of regulatory requirements for documentation of parcels in some Member States;
- for road freight, funding the faster introduction of information technology, investing in border crossing facilities with Eastern Europe, and reform of regulatory controls on vehicle operations;
- for rail transport, applying a competition regime (e.g. concerning State Aid and market organisation) that creates an efficient single market;
- for waterborne transport, promoting the use of information technology, reducing and harmonising customs paperwork, and harmonising port and customs operating practices while minimising restrictive labour regulations and practices;
- for intermodal transport, setting up a competitive and non-discriminatory process for the management of infrastructure (such as rail freight freeways) and for the allocation of scarce capacity;
- for air transport, improving the systems for pricing the use of infrastructure and for slot allocation, improving air traffic control, and collecting more extensive statistical data to support policy development;
- for public transport, encouraging deregulation through franchising of routes, and promoting the appointment of transport authorities to manage through-ticketing structures and the use of smartcard ticketing.

Twenty-six (of 28) policy measures were shown to have a positive benefit/cost ratio.

Factors have been identified relating changes in the structure of industry and supply chain logistics to changes in road freight demand. Simple explanations, such as ascribing traffic growth to the increase in Just-In-Time production, were shown not to be valid – multiple factors have to be considered. An increase in the average length of haul (typically 20-40%) was identified as the single most important contributor to increased road freight demand.

Between 1995 and 2005, vehicle-kilometre activity and greenhouse gas emissions are expected to show a similar growth path to production. The marginal costs of congestion due to increased freight traffic are expected to increase by nearly 50% over the period. Regulated pollutants such as NO_x will decrease dramatically as cleaner vehicles are introduced.

In response, policy measures may be aimed at reducing transport intensity (i.e. the amount of transport needed per unit of production), shifting freight between modes, increasing the efficiency of transport organisation, making better use of vehicles, and/or using better vehicles and fuels. The following measures were evaluated to be highly effective in almost all supply chains (in descending order of effectiveness):

- Introduce on-board measuring and debiting for emissions.

- Increase fuel tax generally.
- Introduce an "eco-label" for companies achieving best practice in their logistic operations.
- Introduce tradable emissions permits.

The following measures were evaluated as effective across a significant number of supply chains (again in descending order of effectiveness):

- Introduce road pricing.
- Introduce tradable vehicle-km permits.
- Introduce congestion pricing.
- Co-ordinate land-use planning and transport planning.
- Encourage the siting of transport-intensive production and logistics activities at suitable locations.
- Standardise load units (intermodal equipment, pallets etc.)
- Introduce annual road prices.
- Increase vehicle tax generally.

Surveys of operators have indicated that the highest barriers to intermodality are associated with organisational/institutional problems and inappropriate price signals. High investment costs can be a problem, and improved information systems are needed. Technical barriers (e.g. standardisation) are less significant.

Other studies have highlighted further barriers:

- inadequate information flows between the variety of actors;
- problems with slow procedures at border crossings;
- differences in regulations between Member States, e.g. for vehicle size and weight;
- a lack of co-ordination at interchanges (such as different companies working different hours);
- a lack of interoperability between modes, for instance concerning ticketing and information systems;
- pressure on shipping rates and poor profitability have been substantially due to intense cost-based rivalry.

The main barriers *specific to the development of inland navigation* in Europe are the limited coverage of waterway networks, poor flexibility, slow transportation speed, high transhipment costs in ports and pre- and end-haulage, relatively small consignment volumes and difficulties in transporting certain types of goods.

To increase the low modal share of inland navigation, various policy measures have been proposed. These include:

- abolition of the alternate turn system (Tour-de-Role) in France and Belgium and further liberalisation with regard to free pricing and contracting;
- improvement of fleet structure (modernisation and standards of safety);
- harmonisation of technical and legal standards (transport of hazardous goods, safety precautions, liability, etc.);
- further development of the inland waterways' infrastructure;
- guarantee of fair competition between the modes (internalisation of external costs, respect for the environment, working conditions, etc.);
- stimulation of co-operation between transport operators.

To support policy assessment, computer models have been developed for passenger and freight transport to simulate mode and route choice for European networks and specific major corridors. In addition, a modelling tool has been devised for assessing the political and social acceptance of transport measures.

Case study results indicated the following:

- Charging road and air passenger transport with emissions-dependent costs provokes stronger changes in modal split than infrastructure investment, and leads to the development of lower-emission vehicles and aeroplanes.
- New connections from Scandinavia to continental Europe may increase car trips, but passenger train trips would increase even more.
- For cross-Channel freight traffic, any move towards greater use of combined transport and rail must take positive measures towards rail – purely restrictive policies towards road transport would have little effect.
- For trans-Alpine freight traffic, the share of intermodal transport can be increased substantially (e.g. from less than 15% to more than 50% in 2010), particularly by a strong pro-rail strategy.

One study developed policy measures addressing the organisation of the European transport system that promote interoperability and interconnection, economic efficiency and spatial coordination. The study highlighted the following findings and derived recommendations, respectively:

- policies of commercialisation and privatisation continue to be pursued, particularly in air, rail and express coach operations,
- competition should be promoted particularly through extending cabotage and deregulation in inland waterways, rail and express coach operations, and also in input markets, including vehicle leasing, labour and ancillary markets such as baggage handling,
- with respect to urban and regional transport, tendering/franchising should be promoted rather than head-on competition,
- with respect to rail, horizontal and vertical separation should be considered, along with network re-configuration,
- entry barriers need to be reduced with respect to congested air, sea and rail infrastructure possibly through the use of auctioning systems. Entry requirements (vehicle age limits for example) may need to be tightened in the road freight and waterborne freight industries.

The European transport policy information system (ETIS)

The planned European Transport policy Information System (ETIS) is intended to support decision-makers in both public and private sectors in understanding changes in mobility, logistic patterns and the effects of policy measures. Research in the Fourth Framework programme has defined the principles and concepts for ETIS, assessed the adequacy of existing data, and prioritised the data gaps requiring immediate action.

The basic principle of ETIS is to support European policy formulation, using an open structure that is complementary to national and other information systems (and consistent where possible). It will handle new statistical concepts such as transport chains, intermodality, families of commodities with the same logistical requirements, performance indicators for transport quality, congestion and environmental hotspots, corridors and networks, and the accessibility of regions and cities.

A pilot database has been developed to demonstrate the feasibility of ETIS, focusing on freight movements along transport chains.

Immediate action was recommended in the following areas, in order to support policy-making in the short term:

- the collection of origin-destination data for both passenger and goods transport at various geographic levels of aggregation;
- establishing requirements and a data bank for data related to major infrastructure projects;
- assessing the means of collecting data on intermodal flows, particularly from private sector companies by exploiting telematics and electronic data interchange;
- reviewing the existing INTRASTAT system for the collection of trade statistics.

One project tackled the third bullet point and provided an overview of data needs and data availability concerning intermodal freight transport data at a European level, defined an appropriate data collection methodology, and tested the methodology on some case studies of transport chains.

The data collection methodology describes how to define a complete database structure, and how to develop a model for the estimation of missing data. It also specifies the data requirements – the data records should include all relevant variables to follow consignments along the transport chain from the place of production to the place of consumption. The suggested record structure was tested on freight flows from Poland to the Netherlands. This pilot study showed that by combining data sources it is possible to analyse market shares, container flows and transhipments on different routes along a corridor.

There are a number of problems with direct data collection from operators. The most critical is the issue of data confidentiality. The data collection process needs to be done by a neutral organisation, providing guarantees of confidentiality for specific variables, and offering mutual benefits in terms of data access. Much of the required data already exists, but simply is not available to external bodies for confidentiality reasons.

Another project dealing with ETIS identified and recommended methods for compiling and processing information on transport networks and on flows of goods and passengers. It proposed a general architecture and structure for ETIS and a process for its development. A critical conclusion underlying the methods put forward is that data can best be supplied at the national level, but processed at different levels, rather than being assembled into a single centralised and fully harmonised data system. The data architecture should be based on the (top-down) policy questions to be addressed, while working within the (bottom-up) constraints of data availability.

The suggested form of ETIS is that of a network of interconnected co-operating systems, allowing access to external databases, processing that data to create a structured core database, and supporting the analysis and viewing of subsets of data that relate to specific policy issues at regional, national and European levels.
Geographic Information Systems should be used for the visualisation of data, and not for the internal organisation of the data core. Agreement will be needed with Member States on a unique and unambiguous coding scheme for identifying each network link and node in the data core, rather than using geo-referencing.

Pilot studies found that existing national data are too heterogeneous to be harmonised. Nevertheless, trade and transport databases were successfully harmonised in a demonstration tool focused on trans-Alpine traffic.

In other work on decision support tools, guidelines and software have been developed to support decision-making on the trans-European transport networks and other transport investments, taking into account the impacts of multi-modal links on regional development.
The aims of the ASDSS project were to assess the supply/demand situation for container shipping and the current competitive position of the EU shipping industry, and to evaluate industry responses, including implications for flag selection, employment, port selection and policy.

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ANNEX 1 RTD PROJECTS CONTRIBUTING TO THE THEME

This Annex lists the titles and objectives of RTD projects relevant to the theme of freight intermodality. The following Table identifies the RTD cluster(s) to which each project contributes significantly.

Clusters	Sector	Relevant RTD projects
Transfer point efficiency and terminals	*Integrated transport chains*	AFTEI, APRICOT, IMPREND, IMPULSE, IQ, PLATFORM, PRECISE-IT, ROLLING SHELF, TACTICS
	Waterborne transport	EUROBORDER, INTRA-SEAS, SPHERE, WORKPORT
	Strategic research	EMOLITE
Efficiency of networks and freight transport services	*Integrated transport chains*	IQ, IRIS, OSIRIS, PROMOTIQ, SCANDINET, UTI-NORM
	Waterborne transport	EUDET, IPSI
	Rail	EUFRANET
	Strategic research	WORKFRET
Transport of goods in and around cities	*Integrated transport chains*	FREIA, FV-2000, IDIOMA
	Urban transport	LEAN, REFORM
Information and communication systems	*Integrated transport chains*	CESAR, INTRARTIP, ITESIC, LOGICAT, OCTOPUS, PISCES, PLATFORM, PRECISE-IT, X-MODALL
	Waterborne transport	3SNET, INFOLOG, MARNET, PROSIT
	Rail	FIRE
Market-oriented strategies and socio-economic scenarios	*Waterborne transport*	ASDSS, EMMA, SHIFTING CARGO
	Strategic research	EUROSIL, INFOSTAT, INFREDAT, MESUDEMO, MINIMISE, SORT-IT, STEMM
	Road	REDEFINE

Other multilateral research actions in Europe are also of interest for the theme, but are not reported here. These include COST 315, COST 330, COST 339, COST 320 and COST 321. Co-operation on freight transport research has been agreed with the Central and Eastern European Countries (RETRA-EST), the Mediterranean countries and the USA (periodic EU-US Forum).

Acronym	Title	Objective(s)
3SNET	Short sea shipping network	The main objective is to define, implement and assess an information, booking and management system, providing a single interface between shippers, carriers, transport operators, etc. Its goal is to integrate short sea shipping in the intermodal chains primarily in regions such as the Atlantic Arc where waterborne transport is a self-evident alternative to land transport.
AFTEI	Air freight transport and European intermodality	The project aims to identify actions that will help to integrate air transport into door-to-door freight transport services, particularly through more effective use of airport terminals.
APRICOT	Advanced pilot tri-modal transport chains for the corridors West	The innovative aspect of the project is the systematic integration of the inland waterway system in optimal, logistic door-to-door chains outside the narrow scheme of the river Rhine area. It aims to link inland navigation with rail transport to areas in south and south-east Europe, with road service for the final distribution to local areas.
ASDSS	Analysis of supply and demand of shipping services	The aims of the project are • to assess the supply/demand situation in container shipping markets, with particular emphasis on European routes, and provide an outlook for future balances; • to assess the current competitive position of the European container shipping industry; • to review industry responses (e.g. capacity management, cost control, industry restructuring).
CESAR	Co-operative European system for advanced information distribution	The objective of CESAR is to establish and test the basis of a common standard interface for information and data exchange between combined transport operators and their clients, mainly road hauliers and freight forwarders.
EMMA	European marine motorways	The aim of the project is to evaluate the feasibility and cost-effectiveness of high-speed sea freight ferry services as an alternative to long-distance freight transport by road.
EMOLITE	Evaluation model for optimal location of intermodal terminals in Europe	The strategic objective of the project is to contribute to the development of modern European intermodal transport networks by integrating all relevant supply and demand requirements of intermodal distribution and transhipment centres, as well as passenger terminals. For this purpose, EMOLITE will develop and demonstrate a decision support system for evaluating the optimal location of intermodal terminals.
EUDET	Danube waterway	The research study EUDET will provide a comprehensive evaluation of the Danube waterway by identifying preconditions and measures that will turn the Danube into a key transport infrastructure for east-west European transport flows on the south-east axis.
EUFRANET	European freight railway network	The project aims to identify and evaluate strategic options for the development of a Trans-European rail network, mainly dedicated to freight transportation. It analyses the present situation and proposes concepts and solutions to reduce freight transport costs and improve quality and services. EUFRANET also deals with the improvement of rail freight transport organisation and interoperability, and the identification and evaluation of new rail technologies for freight.

Acronym	Title	Objective(s)
EUROBORDER	The port as a hub in the intermodal chain	The project aims to identify and assess improvements in port procedures and their expected effects on intermodal traffic. It will examine the processes involving vehicles and load units, and analyse the related information flows, within the ports as well as between ports and their different customers (e.g. forwarders and shippers).
EUROSIL	European strategic intermodal links	This project will provide a set of guidelines, criteria, modelling and evaluation tools for analysing modal split, intermodality and interoperability in European transport networks.
FIRE	Freight information in the railway environment	The project aims at building up an information service prototype for rail-based international freight transportation. The service is designed to respond to the needs of the users of the European rail system.
FREIA	Networking of European freight villages	The project aims at facilitating the access of SMEs to intermodal transport, and focuses on the establishment of commercially viable links with freight villages, their services, procedures and information systems.
FV-2000	Quality of freight villages' structure and operations	The main objectives of the project are to analyse and evaluate freight village structure and layout in order to determine whether the proximity of different transport and logistics activities is a key factor in the use of intermodal transport. It aims to establish the merits and limits of the development of freight villages for the enhancement of intermodal transport competitiveness.
IDIOMA	Innovative distribution with intermodal freight operation in metropolitan areas	The success of intermodal transport depends strongly on the managerial and organisational performance of the pre- and end-haulage of the intermodal transport leg. The project will show how distribution of goods in metropolitan areas can be improved.
IMPREND	Improvement of pre- and end-haulage	The main objective is to identify and test concepts for the efficient operation of the pre- and end-haulage segments of intermodal journeys, particularly through improved management of terminals.
IMPULSE	Interoperable modular pilot plants underlying logistics system in Europe	The main objectives are to assess and test technologies for integrating terminal operations, such as transfer facilities and railway rolling stock, which will result in the increased efficiency of intermodal transport to deliver trans-European freight at lower cost.
INFOLOG	Intermodal information link for improved logistics	The project aims at identifying the function of each actor in the transport chain, and determining the need and rules for information exchange between them.
INFOSTAT	Information systems	The aim of the project is to develop a methodology for establishing transport databases and information systems required for strategic transport planning at a European level.
INFREDAT	Methodology for collecting intermodal freight transport data	The project aims at developing a consistent methodology for collecting intermodal freight transport data.
INTRARTIP	Intermodal transport real time information platform	The aim of the project is to develop a common framework for pre-contract intermodal information systems, aimed at facilitating the exchange of pre-contract information in the intermodal transport sector.
INTRA-SEAS	Safety and economic	The project is aimed at the assessment of possible solutions for

Acronym	Title	Objective(s)
	assessment integrated management of multimodal traffic in ports	multimodal management in terminals and related transport networks. It is based on the development and demonstration of computer simulation tools for assessing the economic and safety performance of management systems and information handling strategies in container terminals and linked inland transportation networks.
IPSI	Improved port/ship interface	IPSI aims to develop methods and equipment for efficient transfer of cargo and information about cargo between land and waterborne transport.
IQ	Intermodal quality	The project will analyse the quality aspects influencing intermodal transport. The main objective is to develop a system of indicators of the quality of intermodal operations, and demonstrate new organisational concepts and evaluation tools.
IRIS	Innovative rail intermodal services	The project aims at demonstrating the feasibility of the bundling concept for container flows and new organisational and informational aspects on short and medium distances. IRIS is building on results from the project OSIRIS.
ITESIC	Integration of technologies for European short intermodal corridors	The aim is to develop and demonstrate a system capable of delivering information to all the relevant parties along a multi-modal transport chain, based on linking existing information systems through the Internet and using common standards for interfacing.
LEAN	Integration of lean logistics in urban multimodal transport management to reduce space demand and optimise use of transport mode	The project aims to develop and demonstrate new concepts to distribute and collect goods in urban areas. Current European city-logistic schemes will be reviewed and the feasibility of new concepts analysed, including testing of new systems.
LOGICAT	Concerted Action on logistic, supply and demand chain management in Europe	The aim is to determine fundamentals for formulating an overall European RTD strategy to develop logistics for the purposes of competitiveness and external trade, while reducing environmental and social impacts.
MARNET	Proposal for an inter-regional maritime information network	The MARNET mission statement is to provide a set of open and globally accessible information services to support logistic and multimodal transport operators. This is aimed at enhancing the competitiveness of the European and Mediterranean maritime ports, and of the transport sector.
MESUDEMO	Methodology for establishing a database on transport supply, demand and modelling in Europe	The aim of the project is to develop a methodology for setting up general European databases on passenger, goods and traffic flows, and on transport infrastructure.
MINIMISE	Managing interoperability by improvements in transport system organisation in Europe	The aim of the project is to analyse the European transport market as a whole and to design specific measures in order to promote the interoperability and economic efficiency of the trans-European transport system.
OCTOPUS	Towards distributed heterarchic workflow	To solve current communication problems during cargo tracing, the project will create a common and open distributed method for adaptive

Acronym	Title	Objective(s)
	methods for pro-active tracing of cargo	and pro-active tracing of communication chains and tracking of general cargo through all sections of the logistic chain, from factory to consumer. It will focus on the integration of small, flexible 'inland terminals' that will benefit from the adaptive cargo-tracing OCTOPUS servers.
OSIRIS	Optimised system for an innovative rail integrated seaport connection	The main objectives of the project are to evaluate the potential for developing rail-seaport connections, and to plan an economic hub and spoke system involving different seaports, economic regions in the hinterland and a hinterland seaport centre.
PISCES	Pipeline intermodal system to support control, expedition and scheduling	The project aims to define a solution for sharing information throughout the transport chain without imposing excessive requirements for new technology, information disclosure or additional information management.
PLATFORM	Computer-controlled freight platforms for a timetabled rail transport system	The project's main objective is to design, test and evaluate a more cost-effective way to manage freight-traffic flows through the enhancement of terminal management and the integration of already existing telematic systems.
PRECISE-IT	Precise automatic location system for the management of ITUs and vehicles inside intermodal terminals	The project intends to contribute to the optimisation of intermodal terminal operations. By building on already existing and assessed technologies, the main objective is to set up and test a demonstration system for the automatic location of intermodal transport units (ITUs) and vehicles inside intermodal terminal areas.
PROMOTIQ	Conditions for the promotion of a new generation of intermodal transport services and operators	The project will identify opportunities and barriers for the new generation of intermodal door-to-door freight operators.
PROSIT	Promotion of short sea shipping and inland waterway transport by use of modern telematics	The project aims to support an intermodal brokerage for linking and tuning transport demand and supply, including short sea shipping and inland waterway transport. It also aims to establish a monitoring system for the entire transport chain in areas affecting quality and reliability.
REDEFINE	Relationship between demand for freight transport and industrial effects	The aim of the project is to model the factors affecting the increased demand for road freight transport and the way these factors relate to changes in industrial processes and logistics. Strategies and policies to simultaneously improve freight transport and logistics, increase economic competitiveness and reduce congestion will be developed and evaluated.
REFORM	Research on freight platforms and freight organisation	The project aims to provide guidelines and criteria for designing, locating and organising freight platforms in urban areas. The project focuses on co-ordination of long-distance traffic with city terminals, organisational and operational requirements for successful freight platforms, multimodality, and the operational improvements to be expected from co-operation schemes.
ROLLING SHELF	Rolling Shelf	The project's objective is to improve intermodal transport operations for palletised goods and parcels over short distances using an innovative goods wagon and telematics system.. It aims to eliminate some of the disadvantages of current rail transport by offering a fast and economically attractive alternative to road and air transport.

Acronym	Title	Objective(s)
SCANDINET	Promoting integrated transport in peripheral areas of the Union, case Scandinavia	SCANDINET aims to evaluate the potential for improving access to the infrastructure and information flows for intermodal transport services, in particular for SMEs and isolated flows.
SHIFTING CARGO	Shifting cargo to inland navigation	The main objectives are to improve the utilisation of inland waterways for transportation of cargo, using both short-term and long-term strategies. The results will contain recommendations for service providers and policy-makers, and proposals and guidelines for pilot projects will be issued.
SORT-IT	Strategic organisation and regulation in transport	The project focuses on developing policy measures that address the organisation of the European transport system and which promote interoperability and interconnection, economic efficiency and spatial co-ordination. It aims to identify and assess the impact of deregulation and privatisation of transport infrastructure and operations in the EU and EFTA, and to determine the optimal balance between market competition and transport regulation.
SPHERE	Small/medium-sized ports with harmonised, effective, re-engineered processes	The project approaches small/medium-sized ports not merely as nodal points within the TEN but as autonomous business units, and applies to them the principles of 'business process re-engineering' (i.e. a complete redesign of the port processes). This will result in simpler, more effective and flexible processes and networks.
STEMM	Strategic European multimodal modelling	The aim is to develop a methodology and models to quantify modal split and route choice for passenger and freight transport, as a tool for policy-making in pursuit of intermodality.
TACTICS	The automated conveying and transfer of intermodal cargo shipments	The project will demonstrate that loading bays and the intermodal transfer of palletised goods can be fully automated, electronically managed and networked into computer-based logistics within already existing transport systems. A functional system will be constructed to verify the scheme and demonstrate mechanical engineering, electronic control and logistics software solutions.
TERMINET	Towards a new generation of networks and terminals for multimodal freight transport	The objective is to identify promising innovative directions and develop decision support software for bundling networks, new generation (automated) terminals and terminal nodes for intermodal transport in Europe.
UTI-NORM	Current state of standardisation and future standardisation needs for intermodal loading units in Europe	The standardisation of intermodal transport units within standardisation committees has arrived at a critical state. The project will give recommendations on future steps and associated policy actions.
WORKFRET	Working cultures in the face of intermodal freight transport systems	The aim is to propose improved working practices for intermodal transport systems, taking into account the interests and requirements of the people who operate them.
WORKPORT	Work organisation in ports	Relentless technological innovation continues to change the work environment in ports, with far-reaching implications for work organisation and management. The project aims to assess the impact of new technology on the port work environment and to consider the application of new organisational and management concepts to meet new demands on ports.

Acronym	Title	Objective(s)
X-MODALL	The optimised exchange between all modes of all conforming consignments	The main objective is to evaluate the potential for optimising overland European consignment flows within the road and rail sectors by integrating tracking and tracing systems within a seamless consignment management structure.

ANNEX 2 MAIN FINDINGS FROM COMPLETED RTD PROJECTS

This Annex summarises the findings from completed projects for which the Final Report has been approved or made available (in alphabetic order of project acronyms). Project web page references are provided where known. Summaries of all projects are available from the two web sites given in Section 1 of this paper.

Index of available RTD project results:

Project acronym and title	Key results and policy implications
3SNET: **Short sea shipping network: information, booking and management system**	***KEY RESULTS*** Within the freight industry, the short sea market is still at an early stage in the usage of electronic booking systems, whereas in the deep sea market most of the larger players have their own web sites and booking systems developed. The project aimed to complete a demonstrator schedule display and cargo booking system for the short sea market within Europe. 3SNET has developed a product which can be integrated in the logistics market place once short sea trade will have fully incorporated new communications systems, and in particular the Internet, into commercial activities. Internet technology allows many sites to link to 3SNET and incorporate it into their own portfolio of services without the need to host and support the product themselves. 3SNET can be used for both feeder and door-to-door operations as well as having the ability to handle intermodal connections. The system is designed to improve access to short sea shipping and intermodal services and provides a simple cost-effective booking system that is immediately available. Benefits for the shippers include: • ability to compare competing schedules, • ability to automatically make connections between sea-sea or sea-intermodal services, thus extending the supply chain information available, • zero cost at the point of delivery. • Benefits for the lines include: • a large market can be potentially reached thus increasing awareness of short sea shipping opportunities, • co-operative opportunities can be highlighted between lines to exploit new routes. ***POLICY IMPLICATIONS*** The project findings during the validation process underline the need for the industry to move forward and to take full advantage of the benefits on offer. The short sea market needs such a product as 3SNET, as it is not expected that each operator, many of which are small companies, will wish to invest in his own bespoke system. 3SNET is a generic solution that allow carriers to participate in electronic communication with its customers with minimal investment. 3SNET has a potential to assist new service providers get off the ground as well as carriers to introduce new services and promote existing ones. Some Port Community systems are expanding to incorporate more functionality and encompass a wider range of services that can include products such as 3SNET. Customers today are looking for single solutions to their operations and finding all services within one area is the way to move forward. It is anticipated that 3SNET will be available Europe-wide via the Internet, but this will not exclude access via other means such as existing Port Community Systems which are in place now and in the future. 3SNET should be the “one stop” shopping forum for short sea movements in Europe and provide everything the customer needs to enquire and make his bookings. Its development will strongly depend on industry reaction and internet technology take up. ***PROJECT WEB PAGE:*** http://www.shortsea.net/

Project acronym and title	Key results and policy implications
AFTEI: **Air freight transport and European intermodality**	*The final results of this project were not available when this Thematic Paper was prepared.*
APRICOT: **Advanced pilot tri-modal transport chains for the corridors West**	***KEY RESULTS*** APRICOT has produced: • an appraisal of trimodal (waterway, railroad and road) transport chains in order to reduce environmental impacts, in particular for alpine regions along the main traffic corridors to southern and south-eastern Europe; • recommendations for the appropriate location of a desired trimodal freight terminal in Basle/Switzerland in order to reduce external costs compared to Combined Transport, representing the current baseline; • recommendations to further undertake complex environmental impact assessments aiming at establishing additional multimodal terminals in the middle section of the river Rhine, e.g. at Mainz or Mannheim/Germany, to trigger considerable shifts away from road transport; • recommendations on how to improve interoperability as a mandatory precondition of trimodal transport chains and terminals, such as integrated terminal designs, advanced design of inland barges, the introduction of common Intermodal Transport Units (ITU), various organisational aspects, and the implementation of efficient information systems. ***POLICY IMPLICATIONS*** The study's positive assessment of the opportunities of trimodal transport chains for several regions in Europe should be supported by policy incentives during the implementation stage. The anticipated merger of inland barge, road and rail transport will allow for environmental friendly transport services with considerable impacts on modal shift, thus promoting sustainability in intermodal and interoperable shipments. Policy backing is considered crucial to assure acceptance in the transport market, which earlier attempts to implement trimodal transport chains failed to deliver.
ASDSS: **Analysis of supply and demand for shipping services**	***KEY RESULTS*** The study concluded that pressure on shipping rates and poor profitability have been substantially due to intense cost-based rivalry, while capacity utilisation has been good. On every major trade route, over 30 commercial entities compete with services that are not strongly differentiated. Cost improvements have been easily copied across the industry and then competed away through lower rates to customers. Although there has been significant partnering between carriers, this has focused on the use of vessels, while the resulting joint capacity is still divided up between many companies. Operators continue to respond to the situation by concentrating on cost reduction. As a result, the outlook is for continued poor profitability in the industry. EU operators have increased their market share in recent years, while the proportion of the EU owned fleet that has flagged out is lower than the world average. As cost pressure continues, EU seafarer employment may be affected by further flagging out, although this cost category accounts for less than 5% of a major container line's costs. Instead, the main future impact on EU jobs will be on-shore losses due to the

Project acronym and title	Key results and policy implications
	rationalisation or merger of operators, since on-shore personnel account for around 20% of costs. As average vessel size has increased, total port calls by container vessels are decreasing. As a group and individually, the top ten North European ports have seen relatively small changes in overall market shares, while the top ten Southern European ports have gained share from smaller ports. No evidence was found that container operators are particularly high risk in terms of shipping accidents, and the accident profile of EU container operators is comparable to that of non-EU operators. Therefore policy on maritime safety would seem to cover container shipping adequately. ***POLICY IMPLICATIONS*** ASDSS concluded that a set of European operators is well positioned, either as emerging global players or niche operators. Owing to continued cost competition, they may continue the trend of flagging out to reduce crew costs. However, the next major cost rationalisations will hit on-shore personnel, through economies of scale, IT solutions and process redesign. The challenge for policy is to encourage EU operators to retain their on-shore control centres in Europe, rather than relocating them e.g. to the Far East. In addition, policy action is needed to improve land transport connections to major container terminals, since the increased volumes of inbound and outbound boxes associated with ever larger vessels are leading to bottlenecks and inefficiencies around these terminals. Intermodal solutions involving rail and barge would be significant in taking the pressure off the dominant road links.
CESAR: **Co-operative European system for advanced information redistribution**	***KEY RESULTS*** Combined Transport (CT) operation procedures require the establishment of a seamless information chain. A wide variety of communication flows already exist between CT operators and their clients and many of them adopt such modern technologies as computer-generated fax transmission, e-mail, and electronic data interchange. The main objective of the CESAR project was to make intermodal transport more attractive by harmonising information exchange between CT operators and their clients. In particular, CESAR aimed to demonstrate how different systems can be virtually interconnected and offer standard client interfaces to the customers. The main outcome of the CESAR project is a pilot system for communication between CT operators and their clients. The system provides clients with the opportunity to book transportation services, and to get information about the status of their loading units directly via the Internet, without any CESAR specific programs installed on their PCs. Status information is stored in a central database which is continuously updated by CESAR partners, while a booking interface allows clients to contact CT operators directly. The different data exchanged between CT operators and their clients have been organised in accordance with the EDIFACT standardised message structure, in order to facilitate direct electronic data interchange. Strict access rules to common information are defined, since CT operators participating in CESAR may be competitors.

Project acronym and title	**Key results and policy implications**
	POLICY IMPLICATIONS The CESAR project has demonstrated how to create a European alliance of several CT operators through creating one virtual operator towards the client. Other interested operators are expected to join the initial CESAR operators in the near future, thus leading to a step-by-step development of European standards for client-operators and operator-operators interfaces. The main benefits of the CESAR system are obviously addressed to CT operators and their clients, but the improvement of intermodal transport can benefit society as a whole, helping to reach the goal of sustainable mobility. CT operators have the possibility of enlarging their market and increasing the quality of service offered to their clients, while clients can make bookings and get status information more quickly and effectively via the Internet, without the need of major changes to their in-house systems. ***PROJECT WEB PAGE***: http://www.uirr.com/english/Project/cesar.htm http://www.cesar-online.com/
EMMA: **European marine motorways**	*The final results of this project were not available when this Thematic Paper was prepared.*
EMOLITE: **Evaluation Model for the Optimal Location of Intermodal Terminals in Europe**	***KEY RESULTS*** EMOLITE has: • defined the framework for a PC based decision support system that provides comprehensive strategic information on the quality and suitability of potential terminal locations; • produced the prototype of a user-friendly software (implemented in MS Access) that consists of a database and a simulation module, comprising the following characteristics • ranking of alternative terminal locations according to weighted values and criteria, along pre-defined classes (cost, flexibility and reliability), attributes (link to the class) and objects, • flexibility in handling terminal attributes, • algorithms for solving the rating and ranking based on a fuzzy multiple attribute model, • interactive and user-friendly interface by providing wizards that help to define the framework of transportation and criteria, and • inclusion of visualisation and presentation features, such as charts, reports, graphs and maps. ***POLICY IMPLICATIONS*** The principle approach of EMOLITE allows an accurate evaluation of potential sites for passenger and freight terminals, based upon internal (technical, operational, costs) and external (public, private) requirements. Though some improvements are anticipated, e.g. in the fuzzy model by creating more fine-tuned algorithms, in the user interface by including additional functionality, or in the database structure to accommodate more consistent data handling, the EMOLITE software is appropriately

Project acronym and title	Key results and policy implications

targeting decision-makers' and managers' real needs. Hence, a ready to use decision tool can be derived from the EMOLITE prototype.

PROJECT WEB PAGE: http://www.strateco.org/

EUDET:

Evaluation of the Danube Waterway as a Key European Transport Resource

KEY RESULTS

EUDET has:

- performed an in-depth analysis of existing waterway infrastructures on the Danube river and adjacent canals, with respect to
- navigable conditions per river/canal section,
- transport capacity per section, depending on waterway width and depth, the capacity of locks, and headroom below bridges,
- existing ports, their facilities, typical goods and capacities;
- analysed inland ship fleets – i.e. fleet structures and their capacity – per country, design aspects in ship and transhipment technology, existing shipyards, and infrastructure bottlenecks related to the interaction of ports and current fleets;
- has analysed the prevailing transport market conditions in the Danube corridor, e.g.
- recent economic developments in bordering states,
- the current structure of transport markets per country,
- the inland navigation market compared to the rail sector,
- Danube river to sea connections, especially to North Sea and Mediterranean sea ports, with a focus on multi-modal services;
- performed an analysis of trade and transport flows in the Danube region;
- forecast future trade flows based on developed scenarios for the Danube corridor;
- analysed and modelled potential transport volume and summarised the waterway's potential on a per country basis; and
- elaborated recommendations for initiatives aiming to improve the Danube's competitiveness, by identifying needs for investment and schemes for market restructuring.

POLICY IMPLICATIONS

Currently there is a unique possibility to create a powerful inland waterway backbone along the Danube river, as long as road and rail networks in South-Eastern Europe have not reached western standards. This would require a single regulatory framework for EU countries, acknowledged accession countries and countries such as Ukraine, alike. A logical next step then would be the promotion of transnational infrastructure and fleet investments to cope with the forecast growth in transport on the Danube. Finally, new organisational structures and logistics concepts are mandatory to close perceived entrepreneurial gaps.

PROJECT WEB PAGE: http://www.impetus.gr/eudet.htm

Project acronym and title	**Key results and policy implications**
EUFRANET:	***KEY RESULTS***
European freight railway network	An initial market survey showed that the majority of shippers interviewed are satisfied with domestic rail transport, but regard the quality of international rail transport as inadequate. Main criticisms included poor flexibility and reliability, a lack of co-ordination between operators, inadequate information, high costs, unreliable pricing policies, and a failure to co-operate in exploiting logistical systems. EUFRANET modelled the development of demand for freight transport in 2020. Under a "current trends" scenario, rail would continue to lose market share to the road sector, falling from 14 to 9%. By combining the demand model with a model of the railway network, the project then evaluated the potential effects of changes in rail infrastructure and operations. A new assignment of routes to different services was devised, based on three sub-networks: • a core network strongly dedicated to freight, covering the industrial regions of central Europe; • an intermediate network mainly dedicated to freight but also carrying local passenger trains; • a mixed network on which passenger trains would normally have priority. The modelling results indicated that traffic on the dedicated network could increase significantly, accounting for 85% of total freight traffic on just 20% of the rail network. Journey times on this network could be cut by 20 to 30%. The decline in modal share of rail could be reversed, taking the share back up to 16%. Gains in national markets would be of the same order of magnitude as gains in international transport, though varying between Member States. ***POLICY IMPLICATIONS*** The implementation of a dedicated freight network and operating system would require a number of actions: • infrastructure investment to remove bottlenecks (for instance crossing the Pyrenees and the Alps); • the agreement and implementation of standards and systems to overcome a lack of interoperability across the network; • the introduction of a slot scheduling and assignment method for international services; • some degree of harmonisation of the subsystems used by the train operators (pricing, information, reservation, tracking and tracing etc.) ***PROJECT WEB PAGE:*** http://www.inrets.fr/ur/dest/eufranet.htm
EUROBORDER:	***KEY RESULTS***
The port as a hub in the intermodal chain	EUROBORDER focused specifically on small and medium size ports and on port terminals as the node in the transport chain. The aim was to study potential improvements in information exchange, the organisational structure and administrative routines in the terminal and its relations to its customers and the rest of the port community. The project has developed improvement scenarios for four case study ports. The scenarios suggest a wide set of changes to raise cost, time and quality competitiveness. All measures, be it organisational or administrative changes involving investments into technology, infrastructure or equipment, have been collected in a toolbox which can serve as source of inspiration for European ports, port terminals and their customers.

Project acronym and title	**Key results and policy implications**

Many of the scenario ideas can be found as "best practice" in the port industry, particularly in the larger ports, but it is likely that these solutions are not implemented in the small to medium size ports.
EUROBORDER has analysed the effects of the scenarios on transport chains by the development of four network models, which are based upon a few real-life transport chains involving three of the case study ports. EUROBORDER has found that the port costs constitute a rather small part of the total generalised costs for a transport from door to door. The quantitative analysis based on generalised costs shows that even if price and time are important, these two factors alone do not explain the choice of a transport solution. The quality of service provided (such as reliability, flexibility and security) is equally or even more important.

POLICY IMPLICATIONS

Port terminals must position themselves as an integral part of intermodal transport chains (hinterland-port-sea-port hinterland). There is a big uncertainty when it comes to information handling, internally and especially externally. Problems arise from the diversity of customers and their needs, lack of standards and lack of trained staff.
The key issues, or the tree I:s of successful port business are:

- interaction - to actively define a role and a business strategy,
- integration - to coordinate investments and operation to exploit synergies,
- information - to manage the intermodal transport tasks and contribute to the overall goal.

These key issues still have to find their way into port terminal management.
Fine-tuning individual port processes may achieve improvement of port performance. More importantly though, port performance may be improved by changing the actual way the processes are performed. EUROBORDER has identified tools and processes which can be used for creating and assessing individual solutions.
The following four development areas have been assessed as most important by the users:

- improving port terminal efficiency with a focus on “city port” problems,
- developing and implementing feasible communication systems based on EDIFACT, Internet or Extranets,
- the use of technology for automatic identification (standardisation),
- training of staff.

PROJECT WEB PAGE: http://www.isdefe.es/euroborder/index.html

EUROSIL:

European strategic intermodal links

KEY RESULTS

EUROSIL aimed to develop robust guidelines to support decision-making on TEN-T and other transport investments, which would take into account the impacts of multi-modal links on regional development.
Through a series of 12 case studies, EUROSIL identified examples of good practice in appraising the benefits of multi-modal transport investments. However, it was clear that few of the current modelling approaches deal explicitly with regional development effects, and there are further deficiencies in the evaluation of those impacts.
Therefore EUROSIL developed an evaluation framework and software tool to support a structured approach to the assessment of regional development effects. This covers the selection of criteria for the evaluation, the estimation of impacts, and the definition of weighting factors for combining different impacts according to the selected criteria. Guidance is provided on the choice of traffic modelling methods. For those cases where the decision-maker requires a quick low-cost evaluation of alternatives rather than a sophisticated evaluation, EUROSIL has constructed a

Project acronym and title	Key results and policy implications

simplified set of guidelines.

POLICY IMPLICATIONS

The case studies highlighted a number of barriers to intermodality:

- inadequate information flows between the variety of actors;
- problems with slow procedures at border crossings;
- differences in technical standards and regulations between Member States, e.g. for vehicle size and weight;
- a lack of co-ordination at interchanges (such as different companies working different hours);
- a lack of interoperability between modes, for instance concerning ticketing and information systems.

The EUROSIL evaluation framework is now available for use in real-life decisions on the TEN-T and other major long-distance transport projects. Its incorporation into new developments of user-friendly investment appraisal tools is recommended.

PROJECT WEB PAGE:
http://mercator.geocenter.survey.ntua.gr/main/projects/eurosil

FIRE:

Freight information in the railway environment

The final results of this project were not available when this Thematic Paper was prepared.

FREIA:

Networking of European freight villages

KEY RESULTS

One of the main achievements of the FREIA project has been the development of general guidelines and principles for the implementation of a freight village information system. The result of this work is a demonstration model of the information system that can be seen at www.freight-villages.dk.

FREIA found that intermodal transport is being increasingly considered by small and medium-sized enterprises (SMEs) as an acceptable and relevant alternative. However, transport costs are a crucial factor, and a barrier to intermodal transport. Many SMEs require commercial services (booking, information, reservation, etc.), which can be located in European freight centres. Within such centres, the main requirement among SMEs is improved physical facilities, such as office and storage provision and access to electronic information. FREIA recommended a classification system of freight villages according to the services and facilities provided, in order to clarify the market for intermodal transport.

POLICY IMPLICATIONS

The FREIA project supports EC policy actions to integrate SMEs into the intermodal transport system. SMEs play an important role in the transport sector and account for almost 70% of total EU company turnover. In order to retain their competitiveness, FREIA recommended that specific actions should be considered to prepare SMEs for the substantial changes they have to face due to intermodality. These actions may include education, training and information on market developments, as well as the

Project acronym and title	Key results and policy implications
	application of new technologies, providing easy access to information systems and services.
FV-2000:	***KEY RESULTS***
Quality of freight villages' structure and operations	FV-2000 has: • performed case studies in seven European countries covering a total of 14 freight villages (FV) representing two principal models, i.e. integrated FVs and non-integrated FVs, whereby the latter type does not allow for a change of transport mode at the terminal; • carried out some 130 interviews with FV managers, logistics and transport providers, and public authorities involved with planning and developing freight terminals; • found major benefits for regional economic development where integrated freight villages have emerged, owed to improved intermodality, the availability of attractive services, and the proximity of different transport and logistics activities at one site; • assessed the environmental impacts of FV operation with particular respect to dangerous goods; from this assessment three management tools emerged • a Good Practice Code, in the form of a user-friendly handbook (available via the internet or on CD-ROM), addressing transport and storage operations in FV areas, • a Decision Support System (DSS), that has been field-tested by three FVs, meant to help assess the risks connected to handling of dangerous and flammable goods; this DSS builds on a database of some 160 substances and materials, and • a Training Software Tool (again available via the internet or on CD-ROM) comprising technical guidelines for operators, and providing recommendations on communication, organisational matters, professional skills and related training of staff, ultimately promoting the implementation of an environmental management system in FVs. ***POLICY IMPLICATIONS*** From the results of FV-2000 it is obvious that both types of FVs, but integrated freight villages – which allow for modal change and in addition offer a broad range of logistics and transport services at one single spot – more significantly, do foster intermodality and efficiency, as addressed by major themes of current European RTD programmes. ***PROJECT WEB PAGE:*** http://www.freight-village.com/fv2000
IDIOMA: **Innovative distribution with intermodal freight operation in metropolitan areas**	*The final results of this project were not available when this Thematic Paper was prepared.* ***PROJECT WEB PAGE:*** http://www.idioma.gr/

Project acronym and title	**Key results and policy implications**
IMPREND:	***KEY RESULTS***
Improvement of pre- and end-haulage	The objectives of IMPREND were: • to identify current problems and possible solutions for pre- and end-haulage; • to test and evaluate promising solutions at demonstration sites. Interviews showed that the most significant problems were time delays (associated with restricted opening times of terminals, consequent road traffic congestion and the poor punctuality of trains) and a lack of co-operation (e.g. poor exchange of electronic data and a lack of return loads). Twenty-five solutions were identified to help overcome problems. Organisational solutions are dominant, based on improved communications and co-operation. However, successful implementation requires win-win benefits to be identified by the actors – in many cases, pre- and end-hauliers are not the *direct* customers of a terminal, and therefore receive lower priority than the shippers and railway operators. Demonstration projects showed that co-operation *between* pre- and end-hauliers typically fails, due to mutual competition. However, the introduction of round-table meetings of actors *along* the transport chain generated some co-operation. Information and communication technologies appeared to have major potential, but the presence of many small independent road hauliers makes it difficult to get them to participate in a large overall information system unless there is very strong evidence that benefits will outweigh the costs. ***POLICY IMPLICATIONS*** IMPREND concluded that the shipper is the most important actor in the intermodal transport chain. However, it is difficult to influence the decisions of shippers, which form a large and diverse set of companies. IMPREND would recommend fostering better communication and co-operation between them, and this is an area where policy initiatives need to be tested. Other areas where co-operation should be promoted are: • co-ordination of opening times at terminals, shippers, forwarders and container depots, which should cut costs for hauliers; • regular communication between terminal operators and other actors in the transport chain to identify bottlenecks and efficiency savings at terminals; • co-operation between hauliers and intermodal operators to improve planning, data exchange and the organisation of return loads. This requires the co-ordinated development of transport policy on European, national and regional levels. Possibilities for further consideration are: • pilot funding for shippers to experiment with intermodal transport; • the initiation of regular roundtable meetings between companies in the sector; • further demonstration projects to identify and promote good practice in pre- and end-haulage; • providing information infrastructure for data sharing. In addition, further liberalisation of the rail sector is expected to improve the organisation and efficiency of intermodal transport. ***PROJECT WEB PAGE:*** http://www.eia-ngo.com/imprend.htm

Project acronym and title	Key results and policy implications
IMPULSE: **Interoperable modular pilot plants underlying logistics system in Europe**	***KEY RESULTS*** IMPULSE has: • analysed the key infrastructure requirements for integrated terminals, and the current rolling stock used by major European railways; • analysed the potential short to medium distance freight market which can be attracted from current road flows; • analysed operational procedures for the rail part of Intermodal Transport Chains (ITC) and related technical transhipment systems, such as portal cranes; • promoted optimised terminal layouts, improved operational procedures, and the use of advanced Terminal Management Systems (TMS); • performed a survey of current GPS-based Identification, Location and Positioning systems (ILP) and systems already in development; • defined and tested new features of automated freight handling by performing practical tests at intermodal terminal in Padova (Italy), in Noisy-le-Sec (France), and at the Krupp Fast Handling System in Duisburg-Rheinhausen (Germany); • defined, designed and constructed prototypes of new wagons suited for automated operation, and in particular the efficient handling of Intermodal Transport Units (ITUs), which have been tested in loading/unloading campaigns at intermodal terminals; • assessed working conditions and safety regulations at automated intermodal terminals; • analysed technical and organisational aspects of intermodal terminals and their impact on ITCs; • developed simulation models for full scale scenarios, based on the field trials, namely: • the so-called 'Micro Model' consisting of an expert system and a simulation module allowing to evaluate different terminal designs and to validate the operational efficiency and quality respectively, • a 'Macro Model' for analysis of multimodal network efficiency and attractiveness on a pan-European level; and • formulated recommendations on the functional layout of future intermodal freight terminals, recommendations for the optimised design and operation of rolling stock, and recommendations for procedures addressing different shipment distances. ***POLICY IMPLICATIONS*** Faster handling and automated operation are key features to foster additional volume for rail based intermodal freight transport over medium and short distances. In order to compete with road transport, price and quality of rail services need to be competitive. On dedicated backbone routes through Europe innovative shuttle trains, running twice a night, have already proven the potential for significant cuts in costs; a finding that should be underpinned by additional real world testing. Furthermore, it is suggested that international standardisation bodies lead the needed activities, and allow for more small and medium enterprises (SME) to participate in future rail transport.

Project acronym and title	**Key results and policy implications**
INFOLOG:	***KEY RESULTS***
Intermodal information link for improved logistics	Truck transport is the most popular way to move goods in Europe, since it is easy to use, flexible, fast, reliable and transparent (the driver provides status information). However, truck transport creates severe problems for society (such as production of CO_2, congestion, and traffic accidents). Intermodal transport based on waterborne and rail transport as a core can reduce such problems, but it requires more planning and demands more information exchanges since a range of different actors is involved. Better means of generating, accessing and handling information can improve the efficiency of intermodal transport and make it competitive with door-to-door transport by truck. To this end INFOLOG developed, tested and evaluated a Transport Chain Management System (TCMS), a prototype software tool for information and communication management. The TCMS is designed to assist the transport manager in handling the variety of players, restrictions and options characterising intermodal transport solutions. The modular structure of the TCMS makes it generic enough to be used from simple transport supervision to automatic message handling in complex logistics solutions. It can be adapted stepwise to handle more difficult transport chains with an increasing number of functions gradually integrating the complete workflow of transport chain management from stock control and transport service quotations to invoicing. The modular structure gives the TCMS a market potential both as a complete system or as separate units. ***POLICY IMPLICATIONS*** The TCMS is a key factor in making intermodal logistic chains as easy to use as truck transport. It provides the control and the flexibility needed to manage the information exchanged in an intermodal transport chain. The main benefits are addressed to the organisations implementing the TCMS, but other organisations in the intermodal transport chain as well can benefit from the TCMS, thanks to the reduced manual information handling. Together with automated control at the warehouse of incoming and outgoing goods, the TCMS installation is estimated to produce efficiency gains on the order of 30%. The improved speed and quality of the information and the use of a common database helps the forwarder to save about 35% of the present manpower thanks to the automated inventory and the resulting facilitation of the communication with the customer. The possibility of integrating different technologies and information systems and the high degree of automation of the TCMS can be very attractive to the market. Comparing monetary savings with the costs, it is shown that an installation of the TCMS is paid back within two to three years. ***PROJECT WEB-PAGE***: http://www.tfk-hamburg.com/infolog
INFOSTAT:	***KEY RESULTS***
Information systems	The planned European Transport policy Information System (ETIS) is intended to support decision-makers in both public and private sectors in understanding changes in mobility, logistic patterns and the effects of policy measures. INFOSTAT has defined the principles and concepts for ETIS, assessed the adequacy of existing data, and prioritised the data gaps requiring immediate action. The basic principle of ETIS is to support European policy formulation, using an open structure that is complementary to national and other information systems (and

Project acronym and title	Key results and policy implications

consistent where possible). It will handle new statistical concepts such as transport chains, intermodality, families of commodities with the same logistical requirements, performance indicators for transport quality, congestion and environmental hotspots, corridors and networks, and the accessibility of regions and cities.

The most significant data gaps and harmonisation needs concern:
- the social determinants of transport;
- origin-destination flows, especially for transit flows and transport chains;
- intermodal transport demand;
- infrastructure for transport networks;
- data on transport prices and reliability;
- data on the economic and land-use impacts of transport.

A pilot database has been developed to demonstrate the feasibility of ETIS, focusing on freight movements along transport chains.

POLICY IMPLICATIONS

INFOSTAT has recommended immediate action in the following areas, in order to support policy-making in the short term:
- the collection of origin-destination data for both passenger and goods transport at various geographic levels of aggregation;
- establishing requirements and a data bank for data related to major infrastructure projects;
- assessing the means of collecting data on intermodal flows, particularly from private sector companies by exploiting telematics and electronic data interchange;
- reviewing the existing INTRASTAT system for the collection of trade statistics.

In the longer term, ETIS is intended to support any transport policy decision that has a European dimension, notably the development of the Common Transport Policy and the Trans-European Transport Network.

INFREDAT:

Methodology for collecting intermodal freight transport data

KEY RESULTS

The project has provided an overview of data needs and data availability concerning intermodal freight transport data at a European level, defined an appropriate data collection methodology, and tested the methodology on some case studies of transport chains.

The data collection methodology describes how to define a complete database structure, and how to develop a model for the estimation of missing data. It also specifies the data requirements – the data records should include all relevant variables to follow consignments along the transport chain from the place of production to the place of consumption. The suggested record structure was tested on freight flows from Poland to the Netherlands. This pilot study showed that by combining data sources it is possible to analyse market shares, container flows and transhipments on different routes along a corridor.

The basic level of data collection was proposed to involve collation of published statistics, supplemented by periodic interviews and counts (which were evaluated to be less cost-effective). INFREDAT concluded that advanced information technologies such as tracking and tracing and Electronic Data Interchange could be used in the future to enhance the available data and/or or to replace other more

Project acronym and title	Key results and policy implications

expensive collection methods. However, this is not practical at present.

There are a number of problems with direct data collection from operators. The most critical is the issue of data confidentiality. Also there are incompatibilities between information systems and data formats used by different companies, and market actors use a variety of concepts and definitions (rail wagons, lorries, loading units etc.) to count their traffic. INFREDAT concluded that the data collection process needs to be done by a neutral organisation, providing guarantees of confidentiality for specific variables, and offering mutual benefits in terms of data access. Much of the required data already exists, but simply is not available to external bodies for confidentiality reasons.

POLICY IMPLICATIONS

The main user group for intermodal freight data was identified as the national and European planning/policy levels. Many operators and shippers reported that they generally have the data they need for business purposes. Therefore INFREDAT concluded that the responsibility for the co-ordination of data collection and processing lies in the public sector, with the data quality and content focused on policy needs.

Of course, the collection of freight data is just a part of the wider requirement for transport statistics. Therefore the INFREDAT results feed into the overall effort to develop a European Transport policy Information System (ETIS).

One of the major growth areas for long-distance freight transport is across the borders with Central and Eastern Europe. At present, customs data provide a good source of statistical information. However, this source could disappear as a result of EU enlargement, therefore special attention will have to be given by ETIS to the specific conditions of these transport markets and their statistical systems.

PROJECT WEB PAGE: http://www.infredat.ptv.de

INTRARTIP:

Intermodal transport real time information platform

KEY RESULTS

The information exchange in intermodal transport is characterised by a number of diverse modalities each with own terminology and regulatory framework, and by a complex network of small and large organisations each with its own culture, organisation and degree of automation.
The INTRARTIP project was aimed at designing and testing an open, globally accessible and comprehensive set of information services able to support the pre-contract stage of the intermodal transport. Market information useful for organising the delivery of cargo and for setting bookings, trade agreements and contracts is included, as well as information including infrastructure capabilities, routes, facilities, timetables, tariffs, reliability of delivery.
The INTRARTIP project has provided a conceptual definition of the full information network and, based on this definition, a working prototype in which a representative portion of the network services has been implemented to demonstrate the full network feasibility.
A survey of user requirements has resulted in a consistent and Europe widely validated list of user requirements and associated constraints for the information platform. Services have been grouped into three categories:

- information platform services, providing a one-stop-shop for information on transport services available,

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- real time services providing capabilities for booking and ordering transport services and getting immediate confirmation, and
- support services providing monitoring information on cargo delivery.

The project has developed a data model, integrating all information relevant to pre-contract intermodal or point-to-point transport, as semantic framework of the INTRARTIP information system. The system architecture includes a service model, defining the services provided by the INTRARTIP platform, a platform architecture including one or more co-operating web servers and a legacy systems interface for services, like booking or tracing, that cannot be provided without accessing legacy systems of transport service providers. The INTRARTIP system has been tested in four pilots envisaging different coverage domains.

POLICY IMPLICATIONS

Three main exploitation scenarios are envisaged:

- a "single transport operator system" scenario where there is only one transport operator who offers its services to its clients;
- a "forwarder system" scenario where the system is used internally by a forwarder to organise its own shipments;
- a "community system" scenario where a group of actors (including transport operators, terminal operators, forwarders) around a transport platform or node uses the system.

The evaluation of the INTRARTIP pilots has concluded that the system is functional in terms of adaptability to the business of the different companies, reliable in case of system malfunction or user error, usable because of a good ergonomics. However improvements are needed in order to provide more accurate information and to reduce process and download times.
The INTRARTIP project has set the basis for the creation of a multi-regional real-time information network able to provide a set of open and globally accessible information services to support the multi-modal transport operators. The proposed network specifically provides information services to support the pre-contract stage of the intermodal transport and can be regarded as a first approach to electronic commerce in transport.
The expected practical result is the acceleration of the market mechanisms leading to a contract between a transport service client and a transport service operator. This contributes to the competitiveness of the European intermodal transport sector by improving the conditions for use and integration of information technology throughout the intermodal transport chain.

PROJECT WEB PAGE: http://www.sequoyah.be/intrartip.html

INTRA-SEAS:

Safety and economic assessment integrated management of multimodal traffic in ports

The final results of this project were not available when this Thematic Paper was prepared.

Project acronym and title	**Key results and policy implications**
IPSI: **Improved port/ship interface**	***KEY RESULTS*** To create effective alternatives to long-distance road freight traffic, the complete intermodal chain that uses waterborne transport as a major component must be competitive with road transport. Since cargo must be transferred between ships/barges and land transport modes (trucks or trains) at least twice, the efficiency of the port/ship interface is of vital importance to attaining such competitiveness. To this end, IPSI developed new concepts for efficient port/ship interfaces in order to make Short Sea Shipping (SSS) the best choice for as large a share as possible of the total transport distance. The project took into account both intermodal SSS terminals and vessels. As for terminals, IPSI focused on the cargo handling system. The system is able to handle the most widely used cargo containment units and uses Automatically Guided Vehicles (AGVs), assembled into sets of several carriages and designed to fit under the cargo cassettes standard on the market today. Trailers can be handled using tug-masters and trailer horses. Two designs have been developed for the terminal ramp system: the first is a fixed two-level land ramp; the second is a two-level link span to be used for large variations between high and low water. As for IPSI vessels, the project distinguishes IPSI ships and IPSI barges. IPSI ships are characterised by a mono-hull with two or three decks, full-width stern ramps, straight deck lanes separated by curbs, automatic lashing devices, and simultaneous access to main and weather deck by AGVs and tug-masters. IPSI barges are characterised by full-width RoRo bow ramps, one or two decks, straight deck lanes separated by curbs. ***POLICY IMPLICATIONS*** IPSI terminals have the potential to become efficient hubs in intermodal chains, particularly when served by IPSI vessels. The cost comparison of different transhipment systems (container terminals, IPSI terminals and RoRo terminals) indicates lower investments, lower costs per TEU and a higher throughput for IPSI terminals. A detailed simulation model proved also that the IPSI system (terminal plus vessels) guarantees substantial time savings when compared to current systems. The IPSI project can substantially contribute to facilitating a shift in cargo transport to waterborne modes in the future integrated Trans-European Network. Investments will be required to adapt terminals and vessels to the IPSI concepts. It should be noted, however, that the terminal and vessel designs developed by the project are very flexible: IPSI terminals can be used by conventional ferries and other RoRo vessels, and IPSI vessels may call upon any port able to support a RoRo operation, because the only difference to conventional RoRo vessels is the steering and control system for the AGVs within the decks.
IQ: **Intermodal quality**	*The final results of this project were not available when this Thematic Paper was prepared.* ***PROJECT WEB PAGE:*** http://www.inrets.fr/ur/dest/progeuro.htm
IRIS: **Innovative rail intermodal services**	*The final results of this project were not available when this Thematic Paper was prepared.*

Project acronym and title	**Key results and policy implications**
ITESIC: **Integration of technologies for European short intermodal corridors**	***KEY RESULTS*** ITESIC has: • established the prototype of a centralised, web-based communication node, that allows to handle inhomogeneous information from various sources in a complex shipment process; • connected and integrated several transport modes (i.e. rail, railway and waterborne), logistic providers, forwarders, agents and depots into a main 'umbrella' module, successfully improving information flow, trackability and reliability of short to medium distance shipments; • successfully demonstrated and customised the Internet based concept with the players and users in the existing medium haul corridors: • Valencia – Madrid, comprising a maritime leg with incoming and outgoing cargo to the port of Valencia, a connection to the railway services to and from Madrid, and road transport to and from the Madrid terminal to final destinations, and • Marseilles – Lyon, comprising a maritime leg to and from the port of Marseilles, a connection with inland waterways services and road transport to and from the Lyon station to final destinations; • additionally validated the benefits of the concept using a 'Virtual Intermodal Chain Simulator', which yielded an overall positive resonance to the chosen approach. ***POLICY IMPLICATIONS*** The demonstration phase of ITESIC has confirmed the idea of a centralised information and communication node for regional intermodal transport corridors. Because a web-based communication interface eliminates the need for direct connection of numerous disparate systems, the concept shall be applicable and adaptable to other intermodal transport corridors across Europe. The exploitation of the ITESIC experience in further case studies should therefore be promoted. ***PROJECT WEB PAGE:*** http://itesic.portel.es/
LEAN: **Integration of lean logistics in urban multimodal transport management to reduce space demand and optimise use of transport mode**	***KEY RESULTS*** Concepts for city logistics were studied in abstract and with reference to approaches being considered in eight cities (Seville and Cordoba, Spain; Norwich, UK; Vienna, Wiener Neustadt and Linz, Austria; Regensburg and Halle, Germany). Estimates of utility value showed that integrated strategies combining infrastructure, information technologies and the provision of door-to-door freight services are the most effective in meeting stakeholder objectives. In Vienna, the introduction of a city freight terminal was estimated to offer a cost saving of 10% to freight service providers. Two concepts were developed in greater detail – load zone management and electronic logistic management. Load zone management is a system for automatic reservation of space in a city centre zone for loading and unloading lorries, supported by stricter enforcement of regulations to prevent illegal parking by private cars in that zone. It aims to reduce traffic jams due to parked cars and lorries blocking the street. A system was designed based on Internet access, making it available to a wide range of users without them needing special software. Messages would be transferred from the central reservations system to a display panel at the loading zone via the mobile phone

Project acronym and title	Key results and policy implications
	network. A logistic management system provides a basic structure for electronic data processing from source to destination along a logistic chain, to facilitate integrated planning, monitoring and control of the movement of goods. This can support the consolidation of goods into fewer vehicles. A prototype system was developed, tailored to the needs of a logistic service provider. The system was shown to manage the required tasks with full functionality. ***POLICY IMPLICATIONS*** LEAN concluded that public administrations need to give active support in promoting the co-operation between market actors that is essential in establishing city logistic solutions and providing multi-modal hubs for freight transfer. The setting-up of regular stakeholder meetings is one aspect of this. In addition, promotional and restrictive measures may be needed to control freight traffic, such as the enforcement of loading zone regulations. A change in modal split between road and rail and the use of low-emission vehicles are also likely to need some policy-based encouragement. However, the case studies suggested that city authorities have only limited understanding of freight transport issues, and focus their planning effort instead onto passenger transport. Therefore LEAN recommended a Europe-wide information campaign targeted on city planners to address this problem.
LOGICAT: **Concerted action on logistic, supply and demand chain management in Europe**	*The final results of this project were not available when this Thematic Paper was prepared.* ***PROJECT WEB PAGE:*** http://www.innovation.eutelis.fr/logicat/
MARNET: **Proposal for an interregional maritime information network**	***KEY RESULTS*** The ever-increasing movement of raw materials and manufactured goods world-wide means that the world of transport is in a state of constant evolution. Information and telecommunications technology is rapidly advancing and today offers multiple efficient services, among them the Internet, satellite communications, vehicle tracking systems and bar codes. The European Union's awareness of the fast development of data technologies in this sector has led it to support the use of new tools by transport and logistics operators in order to increase transport speed and safety while reducing costs. The MARNET project developed an operating prototype of a real-time logistics information network for multimodal transport operators in different regions. The MARNET network provides open and globally accessible information services with the aim to enhance the competitiveness of the European and Mediterranean maritime ports. MARNET focused its analysis on the ten services considered the most interesting by transport operators and port authorities: • The "EU port single desk management service" proposes a harmonised and common interface for document submission; • The "unified dangerous goods service" creates unified procedures for electronically submitting dangerous goods notifications;

Project acronym and title	Key results and policy implications

- The "ship tracing service" provides the current position and route for vessels;
- The "manifest interchange service" allows users to enter manifest information, and generate manifest data in a standard format;
- The "commercial information interchange service" allows agents—shipping lines, logistics operators, shipping agents, etc.—to offer their services via html pages;
- The "port consultation service" provides information about ports and terminals characteristics and their operative situation;
- The "statistics interchange service" collects information on goods and passengers transported and data on the movement of vessels for each port;
- The "Port Cargo Community System in a small port" provides services dedicated to information processing and interchange for small-sized ports;
- The "manifest short sea shipping service" sets up the exchange of short sea manifests between North and South European ports;
- The "exchange interport service" provides interport communications.

The potential of these services has been evaluated by a SWOT (Strengths Weaknesses Opportunities and Threats) analysis.

POLICY IMPLICATIONS

The MARNET project is expected to have substantial benefits to transport operators and port authorities in the field of data interchange. The project's approach can:

- Help simplify the procedures for all Port Communities connected to the MARNET network, by providing harmonised procedures that will be used by all MARNET users regardless of their physical location.
- Combine existing systems and technologies to broaden their usage from local to regional and inter-regional level.
- Make a new set of global enabling services available to the existing systems.
- Provide all Port Communities, whatever their existing information system is today, with a common access to all these services.

PROJECT WEB PAGE: http://www.euromar-eeig.com/initiat/marnet.htm

MESUDEMO:

Methodology for establishing a database on transport supply, demand and modelling in Europe

KEY RESULTS

The aim of MESUDEMO was to identify and recommend methods for compiling and processing information on transport networks and on flows of goods and passengers as part of the European Transport policy Information System (ETIS).

MESUDEMO proposed a general architecture and structure for ETIS and a process for its development. A critical conclusion underlying the methods put forward is that data can best be supplied at the national level, but processed at different levels, rather than being assembled into a single centralised and fully harmonised data system. The data architecture should be based on the (top-down) policy questions to be addressed, while working within the (bottom-up) constraints of data availability.

The suggested form of ETIS is that of a network of interconnected co-operating systems, allowing access to external databases, processing that data to create a structured core database, and supporting the analysis and viewing of subsets of data that relate to specific policy issues at regional, national and European levels.

MESUDEMO recommended that Geographic Information Systems should be used for the visualisation of data, and not for the internal organisation of the data core. Agreement will be needed with Member States on a unique and unambiguous coding

Project acronym and title	Key results and policy implications

scheme for identifying each network link and node in the data core, rather than using geo-referencing.

Pilot studies found that existing national data are too heterogeneous to be harmonised and too scarce to provide European coverage at a satisfactory level of geographic detail for ETIS. Therefore some effort will be needed to encourage countries to enrich and adapt their present systems of data collection. There are also problems with the confidentiality of operators' data to be overcome. Nevertheless, trade and transport databases were successfully harmonised in a demonstration tool focused on trans-Alpine traffic.

POLICY IMPLICATIONS

MESUDEMO concluded that national backing for ETIS is essential, as data will mostly be compiled at that level. However, ETIS will still have to cope with incompatible data collected to meet specific national interests, and therefore should provide data translation facilities. In addition, ETIS should be developed as a set of methods and open and adaptive computational tools, able to cope with changes in policy issues, information technologies and availability of transport databases.

Preparatory actions for ETIS by the European Commission would include the creation of a data dictionary, defining a basic common set of transport information that corresponds to the policy issues to be addressed. A permanent solution is also needed for the institutional arrangements to create and maintain ETIS.

PROJECT WEB PAGE: http://www.telecom.ntua.gr/mesudemo/

MINIMISE:

Managing interoperability by improvements in transport system organisation in Europe

KEY RESULTS

MINIMISE identified impediments to interoperability in the European transport system, and evaluated the costs and benefits of changes and policy actions that would improve interoperability and economic efficiency.

The project generated detailed case studies and policy recommendations for seven (trans-European) transport applications: parcel services, road freight, rail transport, waterborne transport, intermodal transport, air transport, and urban/inter-urban public transport.

Cost-benefit evaluations were produced for individual measures to improve interoperability (such as improved border control facilities, harmonisation of regulations and investment in Electronic Data Interchange). In a second step, benefit/cost ratios were assessed for packages of policy measures:

- 26 (of 28) measures were shown to have a positive benefit/cost ratio;
- 19 measures would require little public investment;
- 21 measures have a benefit/cost ratio greater than 20;
- 17 of the measures would give significant reductions in environmental impacts;
- only 14 measures would provide benefits for both the consumers and the service providers.

POLICY IMPLICATIONS

The project made recommendations for actions by the European Commission in the following areas:

- stimulating the use of telematics;

Project acronym and title	Key results and policy implications

- stimulating the increased use of modern transport equipment;
- promoting improved interconnectivity and interoperability of transport networks;
- harmonising organisational structures;
- harmonising regulatory frameworks.

Specific policy recommendations included:

- for parcel services, further liberalisation of the letter market, simplification of border crossing procedures, and abolition of regulatory requirements for documentation of parcels in some Member States;
- for road freight, funding the faster introduction of information technology, investing in border crossing facilities with Eastern Europe, and reform of regulatory controls on vehicle operations;
- for rail transport, applying a competition regime (e.g. concerning State Aid and market organisation) that creates an efficient single market;
- for waterborne transport, promoting the use of information technology, reducing and harmonising customs paperwork, and harmonising port and customs operating practices while minimising restrictive labour regulations and practices;
- for intermodal transport, setting up a competitive and non-discriminatory process for the management of infrastructure (such as rail freight freeways) and for the allocation of scarce capacity;
- for air transport, improving the systems for pricing the use of infrastructure and for slot allocation, improving air traffic control, and collecting more extensive statistical data to support policy development;
- for public transport, encouraging deregulation through franchising of routes, and promoting the appointment of transport authorities to manage through-ticketing structures and the use of smartcard ticketing.

OCTOPUS:

Towards distributed heterarchic workflow methods for pro-active tracing of cargo

KEY RESULTS

The need to record and monitor the movement of goods is an essential aspect of the supply chain management. However, the parties involved in goods transport generally use different communication protocols and various recognition methods for checking the cargo.
To solve current communication problems during cargo tracing, OCTOPUS's objective was to design, test and validate a common and open distributed information and communication platform for adaptive tracing of communication chains and tracking of general cargo through all sections of the logistic chain. Such a platform allows all relevant partners in the transport chain to log on to the system and still use their own existing software and hardware.
The platform contains two technical layers:

- a tracing and communication e-mail-based system to process and communicate information to partners;
- a tracking and identification system for gathering information related to physical cargo operations.
-

Both layers were tested and validated at different test sites for two cargo products: forest products and general cargo.
OCTOPUS focused on the integration of small, flexible in-land terminals that can benefit from the adaptive cargo tracing servers. The OCTOPUS's servers are installed on a scalable (i.e. modular and adaptive) and heterarchic (i.e. non-hierarchic) network, and each server supports local translation processes of the communicated messages.

Project acronym and title	Key results and policy implications
	POLICY IMPLICATIONS
	The OCTOPUS's platform allows each entity transported within the chain to be located, goods flows to be optimised, eventual performance bottlenecks to be identified, and delays to be reported, with significant time gains during loading/unloading operations due to adoption of Electronic Transport Labels, read/write devices and e-mail-based communication systems. The distributed non-hierarchic cargo tracing and tracking platform is an efficient answer for managing complex transport corridors, since it allows transport actors to communicate efficiently.
	PROJECT WEB PAGE: http://www.e-webtec.com/octopus
OSIRIS:	***KEY RESULTS***
Optimised system for an innovative rail integrated seaport connection	OSIRIS has provided a simulation tool and generic guidance which freight operators can use to improve the quality of seaport-hinterland connections by trains. This is seen as the precursor to demonstration projects. Key findings from market research conducted by OSIRIS were: • In contrast to a widely held opinion regarding critical distances, intermodal freight transport by rail can be operated cost-effectively over distances shorter than 500 km if the volumes and frequency are high enough. Private regional railway companies could be successful over distances up to 100 km near major ports. • The operation of a rail shuttle does not depend only on the distance but also on the volume, i.e. the frequency of the shuttles and the costs involved. • The application of information and communication systems plays an important role in the development and implementation strategy of intermodal transport. • Additional terminals could be built or existing terminals modified in order to bundle seaport-hinterland transport where there is low volume and a wider area of sources and destinations. • The new and efficient solution for the seaport-hinterland connections by train is based on a configuration which includes three rail services: - seaport container shuttles, bundling container transport flows from different quay sites of one seaport in order to dispatch them towards a dry port; - long-distance trains between the dry port and a hub in the hinterland; - short-distance shuttles, providing rail feeder services to/from hinterland destinations. ***POLICY IMPLICATIONS*** The exploitation of the OSIRIS project depends on the will of decision-makers to reduce the dominance of road transport and to develop intermodal transport. The proposed new rail solution between seaports and their hinterland is a means to solve the bottleneck problems of the European road network close to major ports. OSIRIS has shown that co-operation between all partners in the field of seaport-hinterland transport is necessary to implement freight intermodality efficiently. Decision-makers should, therefore, improve exchange of information (EDI, tracking and tracing, etc.) along the whole transport chain and increase the free access to infrastructure for all operators in order to encourage competition. The necessary synergy between freight operators (shipping companies, port authorities and railway companies) has to be catalysed by policy-makers.

Project acronym and title	**Key results and policy implications**
PISCES:	***KEY RESULTS***
Pipeline intermodal system to support control, expedition and scheduling	Intermodal commodity flows are currently only a mere sequence of separate stages. Intermodal freight transport could be managed more effectively by means of information and communication systems enabling a smooth transfer of data between all parties involved. Using such systems, the transport chain could be scheduled and managed as a single process, over a range of modes and with different providers, without the need for all the parties to adopt the same information system. PISCES has developed a prototype version of such a system, able to provide real-time information to interested parties via the World Wide Web, without imposing excessive requirements for new technology, information disclosure or additional information management. The PISCES system is an Internet-based track and trace logistics system communicating to external systems using Electronic Data Interchange and E-mail technology. The system gives access to an Oracle database, where data about goods being moved are stored. The PISCES system is provided with a scheduling component that is fed from the PISCES database to produce possible routing, minimising distances and costs. In particular, PISCES deals with the Triangulation Problem, a Vehicle Routing Problem with Time Windows, multi-port and multi-depot, handling side-constraints, suggesting intermodal transport alternatives, and providing a rescheduling facility. ***POLICY IMPLICATIONS*** The project has restricted its focus to freight intermodal chains involving maritime ports. As a consequence, the prime benefits of the project are mainly confined to shipping lines, road hauliers and trading parties. Nonetheless, the PISCES system could be extended and adapted to other legs of a generic freight intermodal chain. The potential benefits from using the PISCES system include: • Reduced costs, • Less unproductive movements, • Less environmental impacts, • Enhanced services to buyers of transport services. The PISCES scheduler, in particular, could play a significant role in assisting with planning and co-ordination of vehicle routes, jobs, etc. to overcome the problem of commercial vehicles travelling excessively. Environmental and economic benefits will result from an improved capability for solving Triangulation Problems in industry.
PLATFORM:	***KEY RESULTS***
Computer-controlled freight platforms for a timetabled rail transport system	One way to cope with the increasing demand and make the intermodal option a competitive alternative of road transport is to implement new cost-effective ways of managing freight traffic flows based on the enhancement of terminal management and the integration of the existing telematics systems. PLATFORM aimed to implement a simulation environment for the assessment of the impacts produced by different technologies and management policies which can be adopted to enhance the performances of freight intermodal terminals for road-rail transfer. A preliminary analysis of users requirements has highlighted the following as main features of computer-controlled freight terminals:

Project acronym and title	Key results and policy implications

- computer-based booking and dispatch systems for the reservation of transport capacity and for the allocations of loading time and position;
- fast loading/unloading devices;
- intelligent gate procedures and automated guidance of trucks to reserved loading places;
- electronic devices to automatically locate and register the ITU (intermodal transport unit) position in the yard;
- computer-aided yard allocation policies.

The adoption of computer-aided management and of new transhipment technologies are the two scenarios that have been simulated in the test site of CEMAT terminal of Verona, "Quadrante Europa".
While at present forwarders and terminal operators are not co-ordinated and the ITU trips are generally planned only manually, computer-aided management would lead, thanks to automation, to lower service times in the various procedures, from the planning of ITU trips to the positioning of ITUs on the yard, and to the road and rail gate management. New transhipment technologies for cranes and lifters would allow to reach the maximum terminal capacity.
It has been demonstrated that the adoption of faster transhipment devices without the support of computer-aided management does not produce significant changes in the performances of the terminal. On the other side the adoption of computer-aided management systems is cost-effective for every actor in the chain. The only foreseen limitation to the effectiveness of such a policy, albeit not negligible, is the necessity of a coral adoption of the necessary devices and systems.

POLICY IMPLICATIONS

PLATFORM has demonstrated clearly that the path to follow for the improvement of the intermodal transport passes trough the adoption of new telematics technologies to realise really integrated computer-controlled freight platforms.
The project represents a first step in this direction since the tools developed can be used as off-line instruments by the low- and medium-level management to analyse and evaluate different policies.
The entire PLATFORM environment can help the high-level management and the decision makers of the intermodal chain to evaluate high-level policies aimed at improving intermodal transport.
In the next future it is possible to develop terminal oriented on-line tools able to choose in every situation the optimal management policy, to drive the operations and to communicate with the trucks arriving to pick-up or deliver ITUs.

PROJECT WEB PAGE: http://www.idsia.ch/platform/

PRECISE IT:	***KEY RESULTS***
Precise automatic location system for the management of ITUs and vehicles inside intermodal terminals	In many intermodal terminals, additional costs, time delays and quality deficiencies are often due to the wrong positioning of ITUs (Intermodal Transport Units) and to the inefficient management of personnel and vehicles dedicated to the moving of ITUs. One of the prerequisite conditions for improving the overall efficiency of the terminal operations is to have in an automatic way the real-time error-free information about the position of all stocked ITUs and moving vehicles inside the terminal. The PRECISE IT objectives were to set up and test a demonstration system for the automatic location of ITUs and vehicles inside intermodal terminal areas, in

Project acronym and title	Key results and policy implications

particular for maritime container terminals.
GPS (Global Positioning System) and acoustic have been selected in the preliminary stage of assessment of system requirements as the most interesting technologies for the set up of ITUs location systems. GPS was already used for precise location systems while it was not clear at the beginning of the project what kind of results could be reached for acoustic technologies. In particular the demonstration system in the La Spezia Container terminal put most efforts in finding a solution for reach stackers which are the most flexible vehicles inside the terminals and often are working in critical conditions from the position measurement point of view.
GPS integrated with a dead reckoning system gives excellent results all over the stacking area and guarantees the accuracy and availability requirement for the position measurement. The acoustic positioning system is feasible in the real environment even if the accuracy and availability requirements are not completely achieved. On the other hand, the combined use of GPS and acoustic systems, even if from the technical point of view is quite easy to implement, does not increase in significant manner the accuracy and the availability of the automatic location system to justify the costs.
The use of a Position Information Server which takes care of all the operations dealing with the management of position data, allows for a functional separation between the determination of the position information and the management of this information for the purpose of terminal operations (taken care by the operator's information system).

POLICY IMPLICATIONS

The potential customers of the location systems studied in the project are mainly maritime terminal operators with a significant traffic volume and high automation level. In any case both systems (GPS and acoustic) have to be improved before they can be put on the market. This is true especially for the acoustic system which still presents a series of problems related to the noise, the installation, the accuracy and the availability. The improvement of the systems means additional costs that will be supported only in presence of a real interest by the customers. On the other hand the costs for an acoustic location system are likely to be significantly less than the costs for a GPS system.
While automatic location systems are likely not to be cost/effective for the inland terminal, they will be necessary to increase competitiveness and efficiency of the maritime terminals. Benefits include elimination of misplaced containers, better vehicle utilisation, improved information flow, fewer human errors and consequent improved safety. More efficient and reliable operations result in turn in lower costs and better quality of service to the customers. Moreover, there is a potential of the positioning information for added automation and additional uses.

PROMOTIQ:

Conditions for the promotion of a new generation of intermodal transport services and operators

KEY RESULTS

PROMOTIQ aimed to identify the opportunities and barriers for companies seeking to develop a new generation of door-to-door multi-modal transport services, and propose guidelines for their introduction to the market.

Through a series of case studies, PROMOTIQ made a detailed analysis of (a) current trends, (b) opportunities for new intermodal services, and (c) barriers to these services, for each of six promising market segments:

- rail traction;
- short distance (<300km) intermodal transport;
- small shipments in intermodal transport;

Project acronym and title	Key results and policy implications

- segments where quality (speed, reliability etc.) is at a premium;
- integration of air transport into multi-modal chains;
- short sea shipping.

An Action Plan has been devised, recommending policy changes at European and Member State levels to promote intermodal transport in each of the six segments. Each policy action has been characterised according to its objective, the responsible stakeholders, time scale for implementation and estimated cost.

PROMOTIQ concluded that deregulation and competition are the key to new intermodal services, with the shippers and transport providers developing joint operations.

POLICY IMPLICATIONS

Priorities for policy changes were proposed to be:

- early moves towards the fair and efficient pricing regimes already proposed by the EC (e.g. for track access and terminal use);
- establishing a pan-European regulator for intermodal transport (with the task of harmonising market liberalisation and access to infrastructure in the EU Member States);
- encouraging public-private partnerships along the transport chain, particularly involving door-to-door shippers;
- providing limited subsidies for new and improved intermodal infrastructure;
- establishing and promoting standards (e.g. for loading units, electronic data interchange and harmonised procedures/documentation at transhipment points and border crossings);
- allocating further funding to research and development, particularly concerning information systems and technologies for faster transhipment;
- continuing the EC PACT programme for pilot actions in combined transport, with specific targeting of the market segments identified by PROMOTIQ as being promising;
- organising roundtable meetings between stakeholders in each Member State, tasked to identify and remove barriers to intermodality.

Specific recommendations for individual market segments were:

- to ensure full and uniform liberalisation of rail track access across all Member States;
- to set up a fair and open system under which different operators can bid for capacity (railway slot allocation);
- to ensure adequate priority is given to freight trains (in competition with passenger services), by setting up rules or establishing freight freeways;
- to improve the quality and capacity of rail links, and add rail links to major airports;
- to promote short sea shipping and improve its quality (e.g. through harmonisation of opening hours, operating procedures and equipment).

PROJECT WEB PAGE: http://www.gruppoclas.it/projects.htm

Project acronym and title	Key results and policy implications
PROSIT: **Promotion of short sea shipping and inland waterway transport by use of modern telematics**	***KEY RESULTS*** Short sea and inland waterway transport are not sufficiently accepted by shippers and forwarders even if the price for transport is much lower than other modes. Improved exchange of information between parties in the market would improve the integration of short sea and inland waterways into intermodal transport chains and improve the quality and reliability required for their acceptance in the markets. PROSIT had two main objectives: • the application and installation of the IM (Interconnectivity Manager) developed in the BOPCOM project to support automated EDI (Electronic Data Interchange) between several internal and external communication partners with and without an own EDP (Electronic Data Processing) system; • the development and demonstration of a toolset enabling to conduct and support business decisions electronically, dynamically and interactively. The main results of PROSIT are the installation of the IM and the development and testing of a new tool, named ProShip, which uses the IM for information exchange with customers or transport industry. The ProShip tool is able to support: • the brokerage between the demand and the supply side, including the pre-calculations of alternatives and the administration of receiving commitments or orders; • the comparison between agreed and planned transport and reality, including information on performance, control of deviations and automated transfer of information to the customer. The PROSIT products have been studied in four scenarios which were established according to different transport relations and structuring of the organisation regarding the use of information technology: • the Rhine-North Sea scenario and the Finland-Rhine scenario, both focusing on intermodal transport chains including inland waterway transport and seagoing barges, • the Mediterranean scenario, focusing on container traffic, and • the Baltic scenario, focusing on the integration between hinterland transport and short sea shipping. Installations and pilot usage of the IM include: • utilisation for EDI purposes and for satellite tracking and tracing usage in the Rhine-North Sea and in the Finland-Rhine scenarios, • foundation of an internet-based integrated shipping management application in the Mediterranean scenario, and • utilisation for EDI purposes in the Baltic scenario. Installations and pilot usage of the ProShip tool include: • shipping price request in the Rhine-North Sea scenario, • business negotiation process, including booking by the customer and confirming the booking by the operator, in the Mediterranean scenario, • matching empty capacity and cargo in the Finland-Rhine scenario, • satellite-based tracking and tracing of cargo, in order to obtain information on the estimated time of arrival and current status of the transport in the Rhine-North Sea and in the Finland-Rhine scenarios; visualisation of cargo positions and vessel movements has been assessed as a major success of the project pilots; • dangerous cargo management, including announcing, verifying and administering information, in the Baltic scenario. ***POLICY IMPLICATIONS*** The systems applied in PROSIT are all based on electronic data communication and interchange. Electronic supported communication is expected to make the transport

Project acronym and title	Key results and policy implications
	industry able to cope with the major changes and challenges arising from increasing trade volumes, liberalisation, environmental policy and the integration towards a truly networking economy, which is accelerated by the breakthrough of the Internet. While e-logistics and e-commerce can be identified as clearly established goals by the large companies in transport and shipping, the tools developed within PROSIT have provided valuable solutions as well as easy-to-use but low-cost applications to the participating SMEs. The business of the SMEs participating in PROSIT has been improved or extended. This is proved by the fact that IM and ProShip installations and applications will be kept operating and running after the end of the project. Improvements and refinements to both IM and ProShip applications implemented are intended by the participating users. ***PROJECT WEB PAGE:*** http://www.maritime.deslab.naval.ntua.gr/mtrans/Projprosit/Prosit.htm
REDEFINE:	***KEY RESULTS***
Relationship between demand for freight transport and industrial effects	REDEFINE aimed to model and quantify the factors relating changes in the structure of industry and supply chain logistics to changes in road freight demand. The project examined the economic, trade and freight transport data of France, Germany, the Netherlands, Sweden and the United Kingdom for the period 1985-1995. The relationship between the value of produced and imported goods and the consequent vehicle kilometres was shown to be complex, with different behaviour in different countries and between different types of commodity. Simple explanations, such as ascribing traffic growth to the increase in Just-In-Time production, were shown not to be valid – multiple factors have to be considered. An increase in the average length of haul (typically 20-40%) was identified as the single most important contributor to increased road freight demand. Forecasts were prepared for the growth in road freight from 1995 to 2005 for the sectors of agricultural products, food and drink, building materials, and transport equipment. In a majority of cases, tonne-kilometres are expected to grow faster than production, but vehicle-kilometre activity will show a similar growth path to production. Sweden is the exception, requiring fewer vehicle-kilometres per unit of production as time progresses. The marginal costs of congestion due to increased freight traffic are expected to increase by nearly 50% over the forecasting period. CO_2 emissions will follow the growth in vehicle kilometres, while regulated pollutants such as NO_x will decrease dramatically as cleaner vehicles are introduced. ***POLICY IMPLICATIONS*** REDEFINE assessed policy measures aimed at reducing transport intensity (i.e. the amount of transport needed per unit of production), shifting freight between modes, increasing the efficiency of transport organisation, making better use of vehicles, and using better vehicles and fuels. The following measures were found to be highly effective in almost all supply chains (in descending order of effectiveness): • Introduce on-board measuring and debiting for emissions. • Increase fuel tax generally. • Introduce an “eco-label” for companies achieving best practice in their logistic operations. • Introduce tradable emissions permits.

Project acronym and title	**Key results and policy implications**

The following measures were evaluated as effective across a significant number of supply chains (again in descending order of effectiveness):

- Introduce road pricing.
- Introduce tradable vehicle-km permits.
- Introduce congestion pricing.
- Co-ordinate land-use planning and transport planning.
- Encourage the siting of transport-intensive production and logistics activities at suitable locations.
- Standardise load units (intermodal equipment, pallets etc.)
- Introduce annual road prices.
- Increase vehicle tax generally.

PROJECT WEB PAGE: http://www.som.hw.ac.uk/logistics/reu.html

REFORM:

KEY RESULTS

Research on freight platforms and freight organisation

Freight platforms are transhipment areas where many transport companies (such as forwarders and logistic service providers) are located, and ideally where at least two transport modes are connected. A database of 96 European freight platforms was created by REFORM, identifying key characteristics such as transhipment volumes, infrastructure, on-site company interactions and financial arrangements.

Based on this analysis, a handbook was developed for local authorities and transport sector companies. The handbook provides guidance and evaluation methods for establishing new freight platforms. Topics include:

- financial and organisational issues, and their impact on the efficiency of platform operations;
- the impact of technology, equipment and design on platform efficiency;
- evaluation of potential impacts on urban traffic and the environment.

The guidelines were successfully tested by computer simulation at sites in Berlin, Brussels, Rome and Madrid. Depending on the local situation, the introduction of freight platforms was estimated to have different levels of benefit:

- In Rome, a network of platforms could reduce the total truck-kilometres driven within the city by 15%;
- In Brussels, transhipment from heavy trucks to vans would actually increase vehicle-kilometres and pollutant emissions, although action against illegal parking would significantly reduce congestion and fuel use;
- In Madrid, the number of delivery trips would be reduced by higher load factors and a cut in the number of empty truck movements, although traffic levels would rise in the vicinity of the platform (reducing speeds by 3%);
- In Berlin, the location of freight forwarders within the city would reduce their truck mileage by more than 40%, yield cost savings for the forwarders and increase the competitiveness of intermodal transport.

POLICY IMPLICATIONS

City-based freight platforms can reduce urban delivery traffic and emissions, as well as facilitating a switch from road to rail. However, experience to date has shown a need for better design work to improve efficiency and financial viability. Many local authorities and operators had requested an evaluation scheme – the REFORM project has met this need.

Project acronym and title	Key results and policy implications
	The handbook does not replace a detailed analysis of the regional characteristics, which is essential for the optimal design of freight platforms. Rather, it provides a structured framework of how to plan platforms according to the specific regional issues. Similarly, the handbook supports, but does not replace, the critical interaction processes between public and private partners to reach agreement on their individual and mutual interests. Freight platforms support economic as well as traffic policy objectives. Logistic centres may help to attract industry. Transport operators can achieve cost savings through co-operation agreements with other on-site companies. The provision of on-site services also increases operational efficiency. The role of local authorities, guided by the handbook, would include the provision of: • suitable sites; • appropriate regulations; • transport infrastructure; • subsidies for other infrastructure, such as the establishment of bimodal transhipment terminals. ***PROJECT WEB PAGE:*** http://www.ivu-berlin.de/reform/reform.htm
ROLLING SHELF: **Rolling shelf**	*The final results of this project were not available when this Thematic Paper was prepared.* ***PROJECT WEB PAGE:*** http://rollingshelf.com/
SCANDINET: **Promoting integrated transport in peripheral areas of the Union, case Scandinavia**	***KEY RESULTS*** SCANDINET demonstrated the viability of creating intermodal transport services in peripheral areas and over short distances on a commercial basis. A study of freight flows revealed a number of factors that are important to the success of intermodal freight transport between the Nordic countries and the Continent: • reasonable intermodal track rates; • a fair railway slot practice; • consolidation of flows into fewer terminals and corridors like continental freight freeways; • correct and relevant information in different phases of the transport chain; • closer co-operation between intermodal operators. By identifying and quantifying important service characteristics for both single-mode and intermodal freight transport, SCANDINET showed that a gap exists between the desired quality of service and that provided. Ultimately, successful operators will be those who combine assurance in meeting service vector requirements with lowest price. ***POLICY IMPLICATIONS*** SCANDINET has demonstrated that there is a need for policy-oriented actions in peripheral areas and over short and medium distances for the development of intermodal freight transport, in spite of small flows, large areas and sparse population in the Scandinavian countries. New fixed links will improve connections from

Project acronym and title	Key results and policy implications

Scandinavia to the European mainland. As all transport from the Nordic countries to continental Europe involves at least one sea leg, port terminals should be considered in all policy measures promoting intermodal transport, because problems arise from incompatibility between ferry and rail terminals. Currently, no port in the Baltic Sea operates a full-sized intermodal terminal that is able to handle complete block trains.

Such policy actions will be integrated into the EC Decision to develop short sea shipping inside the EU (Green Paper, December 1997) and, particularly, with the Nordic countries. From a legislative point of view, the imbalance between transport modes will have to be redressed, either by the re-imposition of certain restrictions on road freight or via the accelerated liberalisation of the rail sector – probably the best solution will involve a combination of both policies.

SCANDINET recommended that the European Commission should speed up initiatives for improving the collection of statistics on international flows of Intermodal Transport Units, in order to support better targeting of policy action.

PROJECT WEB PAGE: http://www.vtt.fi/rte/projects/scandinet/index.htm

SHIFTING CARGO: ***KEY RESULTS***

Shifting cargo to inland navigation

The main barriers to the development of inland navigation in Europe are the limited coverage of waterway networks, poor flexibility, slow transportation speed, high transhipment costs in ports and pre- and end-haulage, relatively small consignment volumes and difficulties in transporting certain types of goods.

Therefore, measures have been proposed covering technical aspects (ports, fleet, freight units), organisational aspects (shipping organisation, service quality, management systems) and market aspects (co-operation, standardisation, marketing skill). Two basic strategies have been outlined:

- integration through restructuring of the supporting policy frameworks and the implementation of the above measures;
- elimination of infrastructure bottlenecks (waterways, ports and information flows).

For transport service suppliers, the main recommendation of SHIFTING CARGO is to focus on the improvement of service quality (the main disadvantage of inland waterways) by means of technical innovations and commercial technologies.

The project has shown that inland navigation could increase its low modal share in the EU transport system and make the most of its potential. For this, a great deal of investment (technical, organisational and political) by the inland waterways sector (service suppliers and policy-makers) is necessary to meet the requirements of users (shippers).

POLICY IMPLICATIONS

Greater integration of inland navigation into intermodal transport chains would require implementation of the following policy measures:

- abolition of the alternate turn system (Tour-de-Role) in France and Belgium and further liberalisation with regard to free pricing and contracting;
- improvement of fleet structure (modernisation and standards of safety);
- harmonisation of technical and legal standards (transport of hazardous goods, safety precautions, liability, etc.);

Project acronym and title	Key results and policy implications

- further development of the inland waterways' infrastructure;
- guarantee of fair competition between the modes (internalisation of external costs, respect for the environment, working conditions, etc.);
- stimulation of strategic co-operation for a better synergy between transport operators.

PROJECT WEB PAGE: http://www.vbd.uni-duisburg.de/details/aktuell/shifting-cargo/SC.htm

SORT IT:

Strategic organisation and regulation in transport

KEY RESULTS

SORT-IT has:

- carried out 152 interviews with national government departments and major transport companies covering characteristics such as legislation, type of regulation and organisation, type of ownership, market structure, reasons for perceived barriers to interoperability and interconnection;
- performed an accompanying literature review about the aforementioned characteristics;
- used several models to assess specific aspects of intermodal transport, e.g. costs and productivity, competition (simulation), interoperability and demand;
- highlighted the following findings and derived recommendations, respectively:
- policies of commercialisation and privatisation continue to be pursued, particularly in air, rail and express coach operations,
- competition should be promoted particularly through extending cabotage and deregulation in inland waterways, rail and express coach operations, and also in input markets, including vehicle leasing, labour and ancillary markets such as baggage handling,
- with respect to urban and regional transport, tendering/franchising should be promoted rather than head-on competition,
- with respect to rail, horizontal and vertical separation should be considered, along with network re-configuration,
- entry barriers need to be reduced with respect to congested air, sea and rail infrastructure possibly through the use of auctioning systems. Entry requirements (vehicle age limits for example) may need to be tightened in the road freight and waterborne freight industries.

POLICY IMPLICATIONS

SORT-IT concluded that policy priority should be on finishing the liberalisation of the European transport market along the introduced measures, with emphasis on inland waterways, short sea shipping and passenger road transport. Once the strategic reorganisation of the transport market is consolidated, focus should switch to increasing interoperability, interconnection and intermodality, which has already been widely established for the air and road freight sectors.

Project acronym and title	Key results and policy implications
SPHERE: **Small/medium-sized ports with harmonised, effective, re-engineered processes**	***KEY RESULTS*** Maritime routes can form an effective, rapid and environmentally friendly link within the overall Trans-European Network (TEN). In this framework, many small- and medium-sized ports (SMPs) can play a substantial role as nodes within the TEN, operating both as transhipment and distribution centres. To fulfil such a role, SMPs must be able to offer excellent connectivity and interoperability with the rest of the multimodal network. Moreover, ports seen as organisations within the logistics chain must fulfil certain operational requirements to become a favourable alternative, in order to attract, satisfy and retain their customers. The SPHERE project applied the principles of "Business Process Re-engineering" to SMPs, in order to eliminate process fragmentation and waste by redesigning from scratch the port processes. To this end, the assumptions underlying the current practices were identified and questioned, and, where necessary, they were dismantled and new assumptions adopted to re-build the process. The main end-products of the project are the SPHERE Toolbox for Port Process Re-engineering (PPR), and the SPHERE Simulation System. The toolbox includes: • generic suggestions for re-engineering operation, complemented by general guidelines for managing the transition period and suggestions for a more effective integration in and adaptation to the framework of small/medium enterprises; • a set of tools to assist ports in understanding how they should apply PPR and how they can progress it according to their particular operating conditions and business environment. The Simulation System is a virtual environment where alternative re-engineering scenarios can be tested prior to any actual commitment of strategic funds. The SPHERE simulator is totally generic and, although written for small- and medium-sized ports, it has the potential and the advantage to depict and simulate the operation of any port. It can be customised to such an extent that sea ports, river ports, inland ports and freight centres can be dealt with. ***POLICY IMPLICATIONS*** The project has proved that the main source of waste in port processes is fragmentation and the main source of fragmentation is the involvement in the process of many entities from different backgrounds and with often conflicting interests. As a remedy to this situation, the SPHERE concept of the Port Value System would bring the actors closer, to form logistics systems that are based on trust and co-operation. The concepts and tools developed in SPHERE assist any small/medium port (or even larger ones) to review its processes and improve them. Radical improvement of port processes would have a substantial positive impact on the competitiveness of SMPs and their customers, with significant benefits at a Pan-European level, such as: • increased efficiency of the TEN, • promotion of intermodal transport, • better access to the periphery, • diversion of traffic from mega-ports, • encouragement of decentralisation, • enhanced European competitiveness.

Project acronym and title	**Key results and policy implications**
STEMM:	***KEY RESULTS***
Strategic European multi-modal modelling	The objectives of STEMM were to develop models of intermodal transport, and to assess barriers to intermodality and appropriate policy actions. Computer models have been developed for passenger and freight transport to simulate mode and route choice for European networks and specific major corridors. These models have been calibrated for selected countries and routes. In addition, a modelling tool has been devised for assessing the political and social acceptance of transport measures. Case study results indicated the following: • Charging road and air passenger transport with emissions-dependent costs provokes stronger changes in modal split than infrastructure investment, and leads to the development of lower-emission vehicles and aeroplanes. • New connections from Scandinavia to continental Europe may increase car trips, but passenger train trips would increase even more. • For cross-Channel freight traffic, any move towards greater use of combined transport and rail must take positive measures towards rail – purely restrictive policies towards road transport would have little effect. • For trans-Alpine freight traffic, the share of intermodal transport can be increased substantially (e.g. from less than 15% to more than 50% in 2010), particularly by a strong pro-rail strategy. Surveys of operators indicated that the highest barriers to intermodality are associated with organisational/institutional problems and inappropriate price signals. High investment costs can be a problem, and improved information systems are needed. Technical barriers (e.g. standardisation) are less significant, but "hardware" deficiencies are apparent in Nordic countries. ***POLICY IMPLICATIONS*** A set of policy actions to improve passenger intermodality have been identified: • internalisation of external costs through pricing measures; • harmonisation of fiscal conditions for transport across Europe; • stimulating investment in the infrastructure of modal interchanges; • improving information systems, especially on the overall transport chain; • encouraging transport operators to supply services based on chains (e.g. by forming partnerships to co-ordinate flows) – by making sure that enough incentives arise in the market place. In the freight sector, policy conclusions were: • Rail deregulation and the introduction of freight-ways could be crucial in increasing intermodality for trans-Alpine traffic. Important complementary measures would be the extension of the rail network and a mileage tax to internalise the external costs of road freight. Any strategy needs to be co-ordinated between the Alpine countries to avoid undesirable detour traffic. • Rail deregulation, rail access subsidies, terminal subsidies and improved logistics can all contribute in increasing the use of rail from Scandinavia.

Project acronym and title	**Key results and policy implications**
TACTICS:	***KEY RESULTS***
The automated conveying and transfer of intermodal cargo shipments	Despite the established use of pallets in European transport and distribution networks, the lack of international standardisation has limited exploitation of integrated pallet distribution systems. The European pallet population has as many non-standardised pallets as standard ones, and most loading interfaces are not compatible with standard pallets formats. TACTICS aimed to show by research, analysis and demonstration that loading bay and intermodal transfer of palletised goods can be fully automated, electronically tagged, tracked, managed and networked within existing intermodal transport systems. The participating companies have proved the viability of transferring palletised goods in an uninterrupted recyclable intermodal distribution chain. The TACTICS system is based on three key products: • standard (ISO-conformed Europallets) or customised pallets, • radio tagging and read/write devices, • three Automatic Loading Units (named SHOTGUN, MAGNUM and EXCALIBUR) for transferring vehicle loads of palletised goods. The MAGNUM ALU has been identified as the most versatile solution. The TACTICS group evaluated two pallet applications: i) a pallet system for supply of consumer goods from source to supermarkets, and ii) a pallet system for manufacturing component distribution.
	POLICY IMPLICATIONS The TACTICS system approach will enable all load types to be collected and distributed in one integrated system. The availability of fully automated distribution solutions identified by the TACTICS group makes it viable to fully exploit the benefits of total electronic management of freight distribution. The benefits for all participant types (the distributor, the warehouse, the freight terminal, logistics groups and transport companies) are substantial: • the seamless automated distribution of palletised goods from source to destination, recycled as a repetitive intermodal cycle; • interoperable warehouse, terminal, transport and material handling interfaces; • exploitation of one point loading, one point unloading pallet packaging solutions to take advantage of a fully automated system; • live or real-time logistics management of freight distribution, by integration of bar code, radio tagging and GPS tracking systems.
TERMINET:	***KEY RESULTS***
Towards a new generation of networks and terminals for multimodal freight transport	TERMINET has: • identified and investigated into innovative networks, which were found to be more efficient when bundling of small flows helps to establish hub-and-spoke concepts for medium to long distances; • identified and investigated into new generation terminals, which were found to be economically viable at high freight volumes (>200,000 units), however requiring to compare them to conventional terminals or shunting yards in terms of real (non subsidised) costs; • outlined cost and performance criteria for clients of advanced terminals; • highlighted harmonisation measures at the EU level meant to promote the operational implementation of new generation terminals; • set up five case studies at existing intermodal terminals (Metz/F, Busto Arsizio/I,

Project acronym and title	Key results and policy implications

Venlo and Valburg/both NL, and Duisburg/D);
- evaluated these case studies in terms of investment and operational costs, and performed transport chain cost comparisons with conventional unimodal (road) transport;
- identified perceived barriers for implementation of new generation multimodal terminals and associated innovative networks.

POLICY IMPLICATIONS

The TERMINET project has tackled the majority of topics concerning the integration of advanced terminals and complex freight networks. However, several aspects need more in-depth research in order to pave the way for the implementation of this concept, such as cost/benefit analyses for the whole network with integrated terminals, the development of efficient feeder services and regional networks, and the evaluation of risks and benefits related to highly robotised and automated terminal operations.
In the context of a refined implementation strategy for new generation intermodal terminals specific transport related barriers should be further investigated and assessed. Finally, the scalability and flexibility of new terminal concepts – primarily for smaller applications – needs to be evaluated.

UTI-NORM:

Current state of standardisation and future standardisation needs for intermodal loading units in Europe

KEY RESULTS

UTI-NORM has:
- surveyed current container standards related to intermodal transport, as well as the role of non-standardised loading units, used in European container shipments;
- has elaborated recommendations to standardise a future European loading unit with the main dimensions of current standard swap bodies, and to include stackability, top corner fittings and certain additional strength requirements to the design;
- specified a standardised future European loading unit that will be suited for all current European transport modes, by
- providing two sizes for road transport (rigid truck and semi-trailer) with optimised height to make best use of the maximum allowed overall vehicle height of 4,000 mm, light weight to avoid tare penalties and rather cheap to produce,
- providing a rail transport unit utilising the maximum clearance of corridors, and loading patterns available with the majority of the current European rail wagon fleet,
- providing a unit for inland waterway transport, designed to be stacked at least four elements high, and
- considering the problems of cellular ships to carry different size loading units, because they are mainly designed to accommodate ISO containers.

POLICY IMPLICATIONS

There are some considerations for transport policy measures that will address standardisation needs of intermodal loading units in Europe, such as keeping the legal framework on dimensions of road vehicles stable, and promoting the evolution of rolling stock towards a combination of pallet wide stackable freight containers and platform chassis configurations. For optimised intermodal operations a maximum gross weight in road transport of 44 t must be allowed, together with the introduction of standardised stackable European loading units of 13.6 m in length. Standardisation of loading units should thereby consider the requirements of inland waterway barges

Project acronym and title	Key results and policy implications
	and rail wagons as well. The inclusion of small European short sea carriers into harmonised EDI and Internet systems for communication between ocean carrier, terminal operator and forwarder shall be promoted by pilot projects.
WORKFRET: **Working cultures in the face of intermodal freight transport systems**	***KEY RESULTS*** WORKFRET has: • reviewed and analysed 'working cultures', and organisational and management structures in current European (intermodal) freight transport; • identified and assessed the impacts of new technologies in freight transport on the number of employed workers, their working conditions, the quality of jobs (e.g. a shift to more high skill jobs), the time pressure dictated by efficiency considerations and the membership to trade unions; • highlighted new logistics and production systems – with respect to reliability, integration, flexibility and cost reduction – and their impacts on the initially defined working cultures; • produced a ranking of ten key issues in the development of freight transport systems; • analysed five national case studies for the implementation of specific technological and/or organisational developments; • identified twelve policy areas addressing the barriers faced by intermodal developments, namely: the size of the freight sector work force, labour regulations, payment; social security, education and training, health and work safety, recruiting, organisational structures, behavioural codes, bargaining, employee and trade union involvement, and the general promotion of intermodal transport; • derived a set of ten policy suggestions based on identified problem areas and policy fields. ***POLICY IMPLICATIONS*** Based on the outlined topics for policy action and the suggestions derived, the implementation of measures needs to be specified in further research studies, in particular focusing on social impacts of organisational and operational changes in the freight transport sector. ***PROJECT WEB PAGE:*** http://hermes.civil.auth.gr/wf/wf.html
WORKPORT: **Work organisation in ports**	*The final results of this project were not available when this Thematic Paper was prepared.* ***PROJECT WEB PAGE:*** http://hermes.civil.auth.gr/workport/wp.html

Project acronym and title	Key results and policy implications
X-MODALL: (X-MOD/1) **The Optimisation of modular intermodal freight systems for Europe 2000+**	***KEY RESULTS*** X-MOD/1 has: • proposed an integrated information system (X-CRS) that manages transport demand (shipper requirements), the supply side, the optimal use of infrastructure and all of the networked assets used; • outlined a hierarchical trunk sector networking structure made up of dedicated components for interconnected nodes and terminals (X-NodeNet), new modular load units (Xpak), a flexible HomeBase/AnywayBase model for road freight (X-Road), and new modular configurations for freight trains encompassing modular wagon groups (X-Rail); • identified possible savings in the range of 10-15% of current costs for intra-European surface freight transport, once the full set of procedures is introduced; further significant savings are possible with respect to the benefits accruing to fully integrated logistics and manufacturing activities (which can not be reliably quantified at this time); • considered and evaluated the potential of transparently integrating the demand side (the supply chain – B2B, B2C, etc.) with the supply side, together with the technical and organisational changes necessary to benefit all of the parties involved, i.e. industry, consumers, manufacturers, suppliers, environmental interests, planners and government; and • proposed a timeline for gradual implementation of market driven changes for the short-term (next 18 months), mid-term (12 to 42 months) and long term (36 to 66 months), that would include software developments, organisational measures, and the gradual introduction of improved hardware into the road and rail sectors. These time scales are possible only if all parties constructively assist and endorse the changes necessary, so that Europe can have the quality of freight services it urgently requires within the next decade and beyond. At the same time, manufacturing and logistics will need progressively to assimilate these enhancements to freight transportation and react accordingly, so that the transportation linking distributed manufacturing activities becomes truly and transparently integrated within the supply chain itself. ***POLICY IMPLICATIONS*** From the results of the X-MOD/1 research study it is obvious that transport policy and the particular regulations derived from it will need to be adapted and revised, in order to allow for improved conformity of multi-modal transport procedures, and significantly better performance across the length and breadth of Europe. Furthermore, the flexibility of adopting the X-MODALL approach will help support EC policy development in terms of cohesion and improved integration of the accession countries, whilst taking account of desired regional developments (subsidiarity).