INNOVATIVE SHIP PILOT RESEARCH

WA-97-SC.2244

Final Report for Publication

June 2001

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2 SUMMARIES

2.1 EXECUTIVE SUMMARY

INSPIRE is a Research and Technology Development project, supported by the European Commission DG VII, Waterborne Transport, under the 4th Framework Program. The project involves 13 partners from 8 countries and is co-ordinated by LMG Marin.

The primary objective of INSPIRE is to demonstrate how, within selected trade corridors, short sea shipping can be made more competitive, as part of an intermodal transport chain. Thus, INSPIRE is a vehicle for moving cargo from road to sea. The following trade corridors have been studied:

Ireland - North West Europe
Spain - Canary Islands
Portugal - Azores/Madeira
Russia (Kaliningrad/Baltic States) – EU

INSPIRE has carried out a strategic analysis of EU shortsea shipping and developed formats for examination of ports, ships and cargo flows and gathered data on all the corridors using these formats. This process has been formulated into a methodology that it is hoped will form the basis for further work in the shortsea shipping arena. The basic constituent of the INSPIRE methodology is the integration of economic, logistic and design issues where products (supply) are developed based upon marked demands.

The INSPIRE methodology includes a simulation tool (TradeStar), suitable for analysis of door-to-door logistics between two or more locations based on criteria for time, cost and environmental issues. TradeStar facilitates determination of optimal routes between two or more nodes and accommodates assessment of ship designs and shipping routes and is thus a tool for innovation in transport studies.

Case studies have been performed on four corridors, having widely different characteristics and data availability, which have provided the background developing the INSPIRE methodology. Innovative aspects, in form of ship designs, port developments and shipping systems, having a potential to improve the current transport situation on the studied corridors have been identified. Implementation of the INSPIRE results, however, requires further work as the time and financial resources within the INSPIRE project were limited.

The generic and transferable deliverables from INSPIRE are:

- A framework for strategic analysis of waterborne transportation.
- Schemas for examination of transport corridors.
- A simulation tool for corridor studies.
- An overall methodology for corridor studies.
- Policy recommendations for shortsea shipping and corridor-specific issues.

The corridor-specific deliverables from INSPIRE are:

- Data and knowledge for the four corridors.
- Identification of innovative issues for the four corridors.
- Identification of further work in order to implement the results.

2.2 SUMMARY

INSPIRE is a Research and Technology Development project, supported by the European Commission DG VII, Waterborne Transport, under the 4th Framework Program. The project involves 13 partners from 8 countries and has been co-ordinated by LMG Marin.

Shortsea shipping

Trade in Europe is fundamental to economic development and intermodal transport is a key factor in facilitating this trade. It is therefore necessary that EU shipping keeps pace with market requirements for the distribution of goods. Some of the operational imperatives for EU shortsea shipping are:

- Cost and time efficiency - compared to other modes of transport.
- Flexibility - to accommodate changes in market requirements.
- Reliability and frequency - to facilitate shippers and receivers demands.

Each of these attributes comes at a cost to the service provider; their relative importance in the provision of a successful service needs to be assessed. To an ever-greater extent shortsea shipping needs to be integrated in intermodal transport chains in order to provide efficient and dependable door-to-door services and preferably using state-of-the-art Information and Communication Technologies (ICT). This is illustrated in Figure 1.

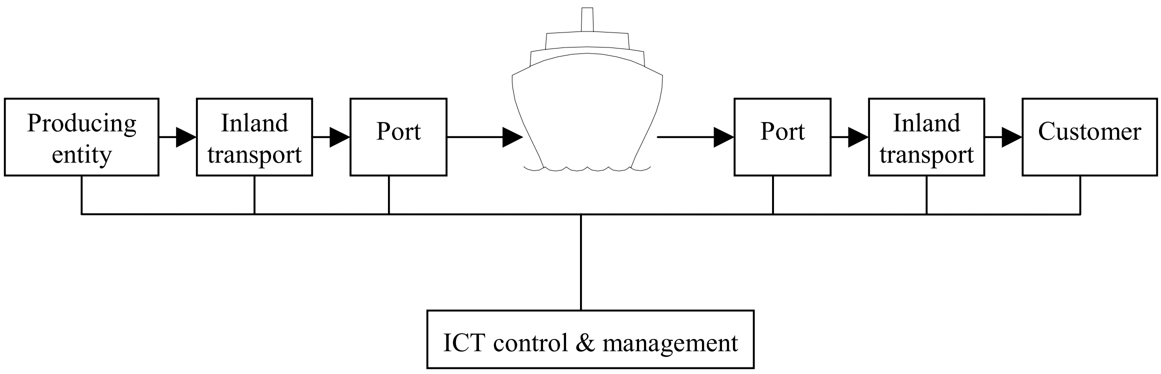

Figure 1: The intermodal transport system

Objectives

The primary objective of INSPIRE is to demonstrate how, within selected trade corridors, short sea shipping can be made more competitive, as part of an intermodal transport chain. Thus, INSPIRE is a vehicle for moving cargo from road to sea. The following trade corridors are studied:

Ireland - North West Europe
Spain - Canary Islands
Portugal - Azores/Madeira
Russia (Kaliningrad/Baltic States) – EU

Critical review of shortsea shipping

INSPIRE has carried out a critical review of shortsea shipping in addition to having performed a strategic analysis of EU shortsea shipping. This resulted in suggesting that shortsea shipping players adopt an aggressive strategy and focus on becoming an intermodal operator where issues concerning the total transport chain are considered rather than only on the ship operation.

Examination of transport operations

INSPIRE investigates shortsea shipping in Europe in order to identify ways that it could be enhanced and win traffic share from land based transport modes. For this to take place, schemas, or procedures, for examination of transport operations were developed. Four areas were identified:

- Ships: to prepare a format for the examination of the design and operational characteristics of selected vessels.
- Ports: to prepare a parallel format for ports, with particular emphasis on the standard of service provided and the levels of charges levied against ships and cargoes.
- Cargo: to develop a format for the examination of cargo movements and trade routes. Each of these tasks was entrusted to separate partners within the consortium.
- VTS: to address the topic of nautical safety and the access to and egress from ports of cargo carrying ships in European waters.

The simulation model

The simulation model (TradeStar) has been adapted and enhanced within the INSPIRE project and is suitable for analysis of door-to-door logistics between two or more locations based on criteria for time, cost and environmental issues. TradeStar facilitates determination of optimal route between two or more nodes and accommodates the assessment of ship designs on waterborne corridors and is thus a tool for innovation in transport studies. TradeStar enables:

- Comparison of shortsea shipping with land based transport.
- Comparison of unitised shipping with bulk feeder services.
- Analysis of multi-port and port to port trading.

This comparison is achieved by using any combination of road, rail, inland waterway and shipping transportation. The comparison criteria include time, charges, reliability (variance in time) and environmental impact. For transportation between two locations the system facilitates the use of alternative routings, different vessels and land transport vehicles and different fuel charges.

Case studies

Case studies have been performed on four different corridors in the INSPIRE project. The corridors have widely different characteristics and the data availability have also varied. The results from the case studies are therefore of various degree of completeness with respect to utilising the results as background for initiating shipping services on the corridors.
The Irish case study considered two separate customer-based case studies. The results illustrated that a shipping system using a combination of ro-ro and lo-lo ships will provide a very competitive service on the Ireland – Continent route accommodating a wide range of the present market requirements. In this respect, two conceptual ship designs have been developed, as illustrated in the appendix, which will accommodate the present market requirements:

- A 21 knot cargo ro-ro vessel.
- An 18 knot open-hatch lo-lo vessel.

The trend in Europe is a change to ro-ro based cargo transportation. However, this should not exclude innovation within the lo-lo sector since this concept is very competitive if turnaround time in port can be reduced. The latter may be achieved through the utilisation of the open-hatch concept.

The Portuguese case study considers innovations in the shipping system between the mainland and Madeira/the Azores using a combination of ro-ro and lo-lo ships. The current system is based upon an old monopolised pattern. The suggested innovative shipping system considers:

- A coastal feeder system between Lisbon and Leixoes feeding Lisbon with island-destined cargo, which also can accommodate the present road traffic.
- The islands are served directly from Lisbon, reducing transport time.
- Overseas liners, destined for the large European container hubs, pick up empty containers.
- Improve management of the trade and co-ordinate export/import between mainland and islands.

The 21 knots coastal ro-ro route provides an interesting opportunity for shipping companies, but further market analysis is needed to identify the potential for unitised cargo. The suggested system for transport between the Lisbon and the islands will improve the cost and time factors compared to the current situation, but there are still unresolved questions as to how to arrange the transport of empty containers from the islands.

The Spanish case study considers fruit export from Lleida to the Canary Islands. The results illustrated that the use of a 25 knots lo-lo cargo ship directly from Barcelona to Canary Islands was the best option considering time, costs and environmental issues. Such a service does not exist today and will form a tailor-made system for fruit exports from Lleida. On the other hand, considering transport in a wider perspective, the case study also considered innovations in the shipping system between the Peninsula and the Canary Islands where two shipping services are suggested:

- Three ro-ro vessels at 25 knots having each a 2800 lane metre capacity and using 48 hours on a roundtrip between Cadiz and the Canary Islands.
- Three ro-ro vessels at 20 knots having each a 2800 lane metre capacity and using 48 hours on a coastal roundtrip between Cadiz and Barcelona having additional port calls along the coast.

The two ro-ro routes will serve a larger market than only fruit exports from Lleida and further work is required to identify the market potential for unitised cargo on these routes. The coastal ro-ro route will be in direct competition with road transport and preliminary analysis is positive.

The Russian case study concerns the improvements of the Port of Kaliningrad in order to make it more competitive and attract Russian destined cargo, which today is transported through the ports in the Baltic countries (Lithuania, Latvia and Estonia). The results show that the Port of Kaliningrad has the potential to become a container terminal for Russia if investments in terminal, VTS and service facilities are made. There is also the question of improving management and marketing of the port.

The INSPIRE methodology

The generic and transferable outcome of the INSPIRE project is the methodology, as illustrated in Figure 2. The methodology is a tool for innovation and it is referred to performing shortsea shipping developments the INSPIRE Way, as the way forward. The basic constituent of this methodology is the development of ship designs or shipping routes based upon market demands.

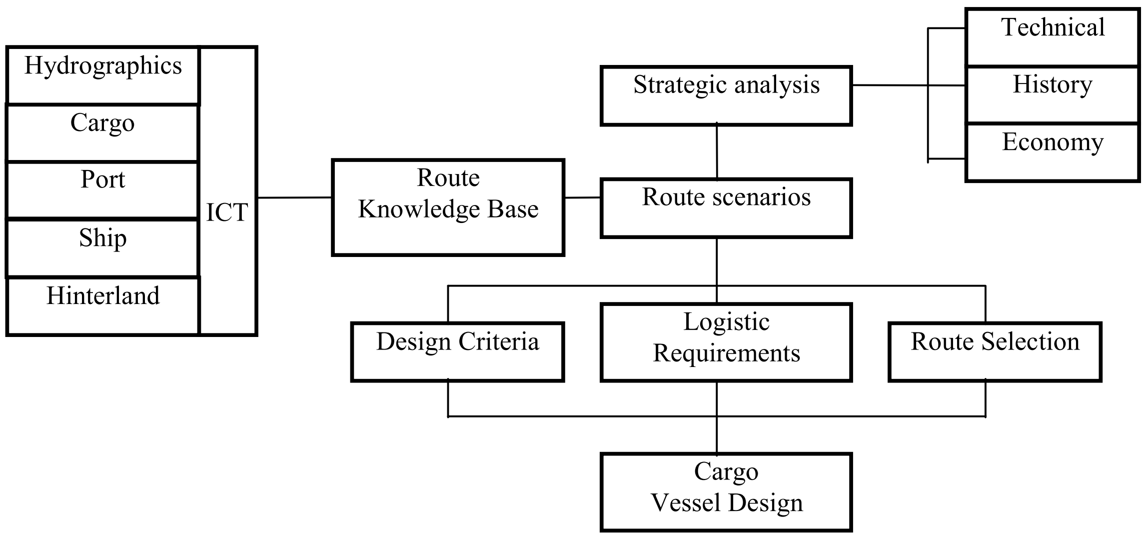

Figure 2: A methodology for shortsea shipping corridor studies

The methodology is centred around a shortsea shipping knowledge base that contain information about ships, ports, hinterland, cargo movements and hydrographics on the trading corridor in question. In order to improve the logistic efficiency and ship, port and hinterland operations, implementations of ICT solutions are given special attention. The information is collected by way of published statistics, literature search, questionnaires, interviews, etc. The information is structured and enhanced in the knowledge base in such a way that it may assist ship designers, service providers, and other industry players in their work.

General knowledge on historical developments relevant for shortsea shipping and major trends in technology and economy is gathered by performing strategic analysis in order to understand the situation today and anticipate possible trends for the future. In this respect, two types of scenarios are present:

- Scenarios for the big macro picture, focussing on possible trend shifts and structural changes in the economy with implications for shortsea shipping.
- Strategic scenarios for the route in question using the knowledge base and based on the macro scenarios and the specific knowledge on ships, ports, and cargo movements.

This enables choosing a specific route and specifying all the logistic requirements for the transportation system. Adding a set of design criteria, the design process can start, ensuring that the resulting vessel has been optimised to fit a specific logistic task.

Policy recommendations

Policy recommendations are given for general aspects pertinent to EU shortsea shipping and aspects that have arisen during the two-year INSPIRE project. These aspects pertain to the use of ICT in intermodal transport, the problem of having access to transport data and the general lack of innovation in shipping services. Furthermore, there are several policy recommendations regarding the four corridors, which may be solved by the effort of local governments. These aspects relate to port, ship and operational matters.

The policy recommendations seek two audiences. Firstly, the recommendations aim to guide industry players on aspects the INSPIRE consortium considers relevant after the two-year research period. Secondly, the recommendations aim to provide policy makers insight to shortsea shipping issues, which may be useful in their work in order to advance the industry.

Dissemination and exploitation strategy

The INSPIRE partners have disseminated the project content and results to a wide audience since the project commenced in 1998. The INSPIRE results, at the closure of the project, are being disseminated towards ship operators and cargo owners with the aim of implementing the results on the studied corridors and to seek funding for the suggested further work.

The INSPIRE project has drawn expertise from several fields within shortsea shipping, such as researchers, designers, practitioners, operators, etc. Therefore is the exploitation strategy using the INSPIRE results distinct for each of the INSPIRE partners. In general, the exploitation of the knowledge and results achieved in the project is very much a focal point for the INSPIRE partners.

Conclusions

The INSPIRE methodology has been applied to the four corridors in question. The results illustrate that the methodology is a valuable tool in order to:

- Decide ship type and speed on the corridor.
- Decide shipping scenario on the corridor.
- Analyse effects of infrastructure investments.

The application of the methodology, as performed in INSPIRE, is a demonstrator and more work is required in order to tune and further enhance the methodology by applying it in industrial projects. This aspect is underway by the INSPIRE partners.

The findings within INSPIRE are being pursued on a commercial basis where the aim is to implement the results in collaboration with ship operators and cargo owners.

The generic and transferable deliverables from INSPIRE are:

- A framework for strategic analysis of waterborne transportation.
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The corridor-specific deliverables from INSPIRE are:

- Data and knowledge for the four corridors.
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- Identification of further work in order to implement the results.

3 OBJECTIVES OF THE PROJECT

3.1 AIM AND OBJECTIVES

The overall aim of INSPIRE has been to provide a methodology for the development of shortsea shipping solutions on specific corridors that are competitive with other transport modes on cost, time and environmental issues.

The primary objectives have been to:

- Provide demonstration platforms for determining the characteristics of EU shortsea shipping that are compatible with trading corridors and ports used.
- Demonstrate that EU shortsea shipping can extend its competitiveness through the application of vessels that are optimally matched to trading corridors and to ports.
- Provide policy recommendations and to recommend on actions that will improve the overall effectiveness of EU short sea shipping.

The operational objectives have been to:

- Prepare an overview on studies and developments in EU shortsea shipping.
- Develop schemas for examination of ships, ports, cargo flows and VTS aspects on the various corridors.
- Develop algorithms for the analysis of multi-port and port-to-port trading.
- Develop a model that will simulate the commercial attributes of short sea shipping vessels on specified trading corridors and assess their effectiveness.
- Investigate specific waterborne corridors using the examination schema and the simulation model.
- Develop strategies for the corridors that will increase the effectiveness and competitiveness of shortsea shipping and hence facilitate trade flows.
- Disseminate the project results to the maritime industry and policy makers in Europe.
- Make recommendations on actions that would further the primary objectives of the study.

4 MEANS USED TO ACHIEVE THE OBJECTIVES

4.1 THE INSPIRE PROJECT

The Innovative Ship Pilot Research (INSPIRE) is a Research and Technology Development project, supported by the European Commission under the 4th Framework Program. The project involves 14 organisations from 8 countries, as illustrated in Table 1, and is co-ordinated by LMG Marin.

Table 1: INSPIRE partners and sub-contractors

Organisations	Co	Description
Lund, Mohr & Giæver-Enger Marin AS	NO	Consulting engineers and naval architects
NEC, Cork Institute of Technology	IRL	Maritime, IT & transport solutions providers
National Technical University of Athens	EL	Education and research
Baxter Eadie Limited	UK	Ports and shipping consultants
Centre for International Economics and Shipping	NO	Shipping and economy research
Centro de Estudios Technico-Maritimos	E	Maritime consultants
FRESTI-Sociedade de Formacao e Gest	P	Maritime management and consultant
Trans Rail West	RU	Rail transportation group
Baltic Marine State Academy	RU	Education and research
APT	IRL	Translation services
Universidade Tecnica de Lisboa	P	Education and research
Marine Integrated Response	IRL	Maritime and nautical consultant
Universidad de Las Palmas de Gran Canarias	E	Education and research
Marine Analytics	NL	Port and safety consultants

The primary objective of INSPIRE is to demonstrate how, within selected trade corridors, short sea shipping can be made more competitive, as part of an intermodal transport chain. Thus, INSPIRE is a vehicle for moving cargo from road to sea. The following trade corridors are studied:

Ireland - North West Europe
Spain - Canary Islands
Portugal - Azores/Madeira
Russia (Kaliningrad/Baltic States) - EU

INSPIRE has carried out a strategic/SWOT analysis of EU shortsea shipping and developed formats for examination of ports, ships and cargo flows and gathered data on the corridors using these formats.

Scenario workshops have been performed on the corridors. Innovative aspects having a potential to improve the current transport situation on the corridors have been identified. Implementation of the INSPIRE solutions, however, requires further work as the time and financial resources within the INSPIRE project have been limited.

On the background of the experience and knowledge gained in the case studies, the INSPIRE methodology, comprising a simulation tool (TradeStar), has been developed, which is suitable for analysis of door-to-door logistics between two or more locations based on criteria for time, cost and environmental issues. TradeStar decides the optimal route between two or more nodes and accommodates the testing of new ship designs on new or existing routes and is thus a tool for innovation in transport studies. The INSPIRE methodology is the transferable and generic deliverable from the project.

4.2 EU SHORTSEA SHIPPING

Trade in Europe is fundamental to economic development and intermodal transport is a key factor in facilitating this trade. It is therefore necessary that EU shipping keeps pace with market requirements for the distribution of goods. Some of the operational imperatives for EU shortsea shipping are:

- Cost and time efficiency - compared to other modes of transport.
- Flexibility - to accommodate changes in market requirements.
- Reliability and frequency - to facilitate shippers and receivers demands.

Each of these attributes comes at a cost to the service provider; their relative importance in the provision of a successful service needs to be assessed. To an ever-greater extent shortsea shipping needs to be integrated in intermodal transport chains in order to provide efficient and dependable door-to-door services and preferably using state-of-the-art Information and Communication Technologies (ICT). This is illustrated in Figure 3.

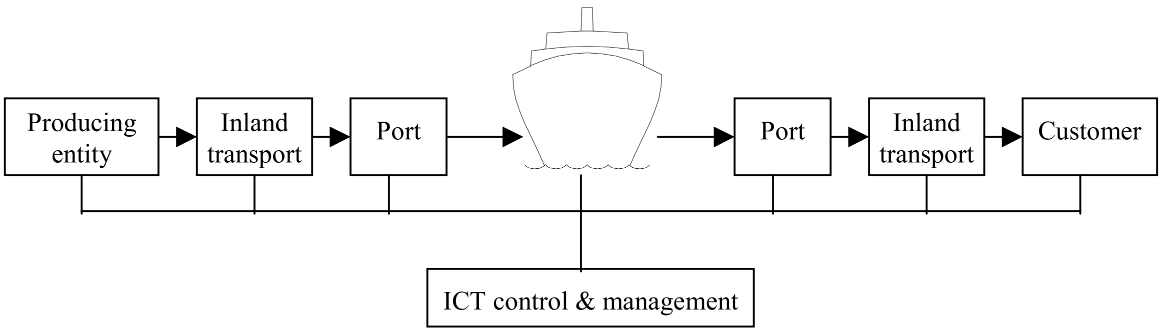

Figure 3: The intermodal transport system

Integration of services necessitates smooth interfacing between ship and port/terminal operations, rapid port turn-round times and an efficient clearance system of cargo through ports and transfer to/from land modes. The transport must have an efficient Information and Communication Technology (ICT) control and management providing the necessary level of customer service.

Door-to-door efficiency of unitised transport would indicate that this mode could increasingly be used for the distribution of higher value dry bulk cargoes, resulting in a quantum change from sub-optimal port-to-port operation to intermodal, unitised shortsea shipping.

The use of logistic simulation models is particularly useful in the quest for strategic solutions in transport operations and for determining the characteristics of vessels that could optimally be used. Consignors/consignees require real-time information on the location of their cargoes in transit - for planning, for security and for comfort.

A key factor in the provision of high quality shipping services is the employment of high quality EU personnel who view shipping as part of the total transport network and whose careers are open-ended within the transport industry. The use of EU owned and operated vessels manned by EU personnel on shortsea routes ensure that maximum benefit from shortsea shipping accrues to EU states.

Greater utilisation of shortsea shipping would result in fewer land freight miles, the reduction of avoidable movement of goods across intermediary states and more environmentally friendly and energy conserving transport.

To help promote EU shortsea shipping, innovative shipping concepts must be examined without undue constraints from traditional attitudes and practices. In certain peripheral areas of Europe, there are no alternatives to cargo transportation by ship, because there are no roads or railways connected to the European networks, and because air transport is beyond the economic possibility, except for small quantities of high value goods. For the development of these areas, sea transportation must be efficient, frequent, reliable, safe, and cost effective. Maritime transport has traditionally been a key factor in economic progress in Europe and comprises a rich and colourful part of our history. Our ancestors recognised the strength of shipping as a transport mechanism and sought to exploit and develop trade of goods by commercial and strategic alliances, which fuelled a desire for co-operation that evolved into the EU as it is today. The main thrust of INSPIRE is the competitiveness of EU shortsea shipping. On this background, INSPIRE sought to:

- Provide a demonstration platform for determining the characteristics of EU shortsea shipping in the context of trading corridors and ports used.
- Demonstrate that EU shortsea shipping can extend its competitiveness through the application of vessels that are compatible with trading corridors and ports.
- Provide a framework for the expansion of the EU shortsea shipping fleet.
- Highlight policy implications that are identified in the course of the study and to recommend on actions that will improve the overall effectiveness of EU shortsea shipping.

Four specific case studies has served as practical demonstrations in INSPIRE. These are the:

- Movement of unitised cargoes between Ireland and Northwest Europe.
- Marine transport systems between Spain and the Canaries.
- Marine transport systems between Portugal and Madeira/the Azores.
- Transport between Russia, via Kaliningrad, and North Europe.

The Irish study is the classic case where shipping is in direct competition with road transport using the landbridge across the UK. The connections to the Iberian ultra-peripheral islands are not unique in Europe, and the results of this study will be of benefit to other peripheral regions in Europe. The Russian study should be extremely important in proving the benefits of shortsea shipping, as compared with road and rail in the fast growing market in this region.

4.3 APPROACH ADOPTED

The approach adopted in the INSPIRE project is illustrated in Figure 4.

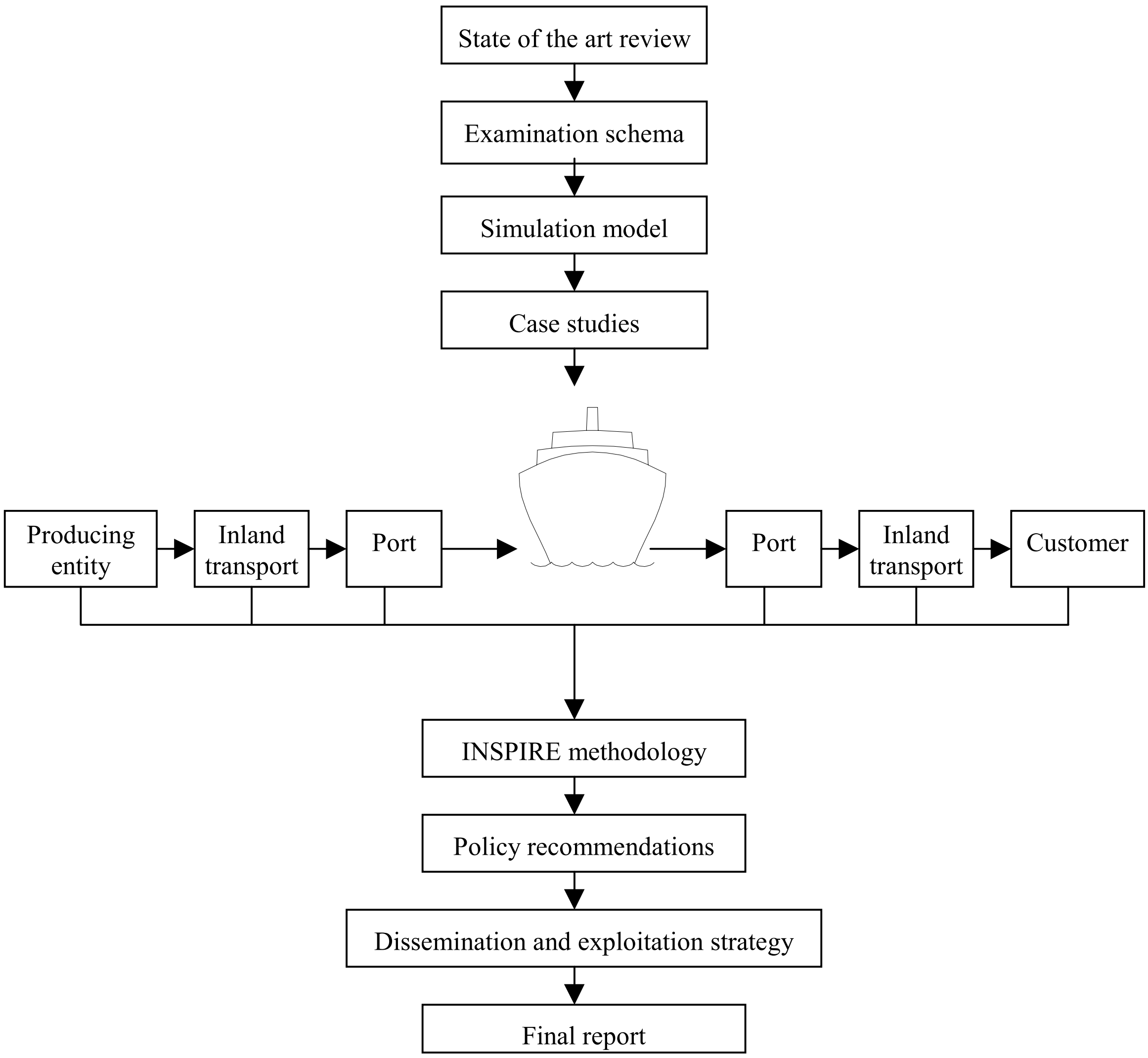

Figure 4: The INSPIRE approach adopted

5 SCIENTIFIC AND TECHNICAL DESCRIPTION OF THE PROJECT

5.1 STATE OF THE ART REVIEW

The INSPIRE partners have performed a state of the art review in the beginning of the project, which has served as input to the other work packages in form of references and knowledge. The scope of WP1 was to review EU and the international research programmes and extract material relevant to the study. The review is outlined in Appendix A.

The state of the art review consists of data on projects and papers pertinent to shortsea shipping in Europe. Furthermore, overviews on historical developments of Shortsea Shipping relevant to each of the case studies are included. In addition, a study report from one of the partners on 'Strategic Analysis of Shortsea Shipping' has been included.

A general trend is the increased focus on shortsea shipping in Europe in the last decade, which is reflected in the number of papers and projects pertinent to this subject. This is believed to have been spurred by the intention by the EU Commission to shift cargo from road to sea. An operational trend is the increased focus on intermodality through the transport chain from manufacturer to consumer and the change of emphasis from logistics to supply chain management. A technical trend is the change from slow and old tonnage to faster ro-ro cargo ships. A socio-economic trend is the stronger emphasis on safety and environment as these factors are becoming predominant in the public's and industry's choice for mode of transport.

There is a vast collection of material, extracted from the Concerted Action's database, as shown in Appendix A. Many papers and studies are relevant to the INSPIRE objectives and these projects provided the partners a base from which to proceed. The extracted material is divided in six categories:

- **General**
  General Interest for Shortsea Shipping
  Material that concerns all the regions of interest
- **Ships and terminals**
  New Concepts for Ships and Terminal facilities
- **Portugal**
  Portugal Ports, Azores Islands, Madeira
- **Spain**
  Spanish shipping industry, Spanish Ports, Canary Islands
- **Ireland**
  Irish Ports, Corridors etc.
- **Baltic Sea**
  Baltic Ports, Bulk Cargoes, Competition etc.

5.2 EXAMINATION OF TRANSPORT OPERATIONS

5.2.1 Summary

The INSPIRE project, undertaken as part of the 4th Framework Programme of the European Commission, is concerned with the promotion of shortsea shipping in Europe through transport research. One of the seven work packages of INSPIRE, Work Package 2 (WP2), is entitled "Development of a Schema for Examination of Transport Operations". It was to be comprised of two phases. The first provided for the drafting in the early part of the study of four separate papers addressing different aspects of European shortsea shipping to assist in detailed investigations on particular routes. The second phase was to take account of the subsequent experience of those working on the case studies, which was to be reflected in modifications to the drafts. The work of WP2 was due to be concluded in the fist half of the study period.

This report traces the development of the work during a two-year period and presents the results. A number of separate papers have been written which are attached as annexes and each is summarised below. While the preliminary purpose of WP2 was to prepare guidance papers to assist those involved in the corridor studies within INSPIRE, which was achieved to a certain extent, a useful side-product, which should have a wider application amongst researchers and others analysing aspects of maritime transport, are the attached series of papers which should help to inform any such enquiries.

5.2.2 Objectives

The Technical Annex gives a full statement of the objectives as envisaged at the outset of the project. In essence, while the whole project aimed to investigate shortsea shipping in Europe in order to identify ways that it could be enhanced and win traffic share from land based transport modes, the primary role for WP2 was to create a schema or procedure whereby that examination could take place. Three areas were identified. Task 1 Ships: to prepare a format for the examination of the design and operational characteristics of selected vessels. Task 2 Ports: to prepare a parallel format for ports, with particular emphasis on the standard of service provided and the levels of charges levied against ships and cargoes. Task 3 Cargo: to develop a format for the examination of cargo movements and trade routes. Each of these tasks was entrusted to separate partners within the consortium.

A fourth task was added at the initial project meeting since one partner, Maran, with specialist knowledge of VTS matters, who had time allotted was able to address the topic of nautical safety and the access to and egress from ports of cargo carrying ships in European waters under WP2. While this aspect involves both ships and ports, and some duplication could result, it has been dealt with as a distinct subject. On short routes with frequent port calls and busy channels used by both commercial vessels and recreational craft this has seemed to be entirely justified.

In addition to preparing for the work of the three case studies it was agreed early in the project that WP2 should help directly with the provision of data required for the deployment of TradeStar (WP3) to assist the process of analysis. Accordingly a further partner, NEC, undertook the task of ensuring that specific data sets were derived. The need to accommodate the particular requirements of TradeStar, as well as adopting a more universal approach, resulted in some duplication of effort.

5.2.3 Programme of work and progress

The objectives, organisation and resources of WP2 were discussed by all consortium members at the project's initial meeting in late January '98. Two weeks later the WP Leader put out a Launch Paper, which set down the proposed approach for the work and the programme to be followed. The main elements were for draft schema to be prepared on time for use by other WPs for feedback to be provided based on experience of use of the schema, and for modifications to be made. The programme was devised with a completion date of end 1998. Schema had been prepared in substantial draft form by the middle of 1998 when the three corridor studies were due to begin. Three conclusions can be drawn on the application of the schema:

1. Relatively little use was made of the initial work of WP2 in the corridor studies. This was the result of the specific knowledge of those working in those WPs, and their concern to address the central issues of their respective studies in their own way.
2. Questionnaires prepared for use in two of the corridor studies, both of which drew on WP2 work, achieved very poor response rates which were so low that little use could be made of data obtained from those sources.
3. One of the main thrusts of INSPIRE has been the use of TradeStar to help with the analysis of data relating to the corridor studies. A definition of the extent of data sets required for TradeStar only became available in 1999; the emphasis of the work then turned to meeting those needs.

The completion of the components of WP2 and the production of the final report have been achieved much later than planned and in association with the end of the whole project. The delay has not had an adverse impact on the other work packages within INSPIRE.

5.2.3.1 Format for examination of ships

LMG have produced a 16-page paper under the above heading with a 7-page questionnaire, which together are attached as Annex 1[1]. This document is a comprehensive review of aspects of ship design presented in a text format. For the non-naval architect it is a comprehensible document, which provides useful background material and alerts the uninitiated to the complexities of the subject. It does not attempt to answer all the questions, or to deliver a step by step procedure by which optimum ship characteristics can be determined.

The paper provides a framework for the technical and economic evaluation of ships with attention being given to the suitability of the particular design for a specific route. The subject is addressed in four sections namely Logistics and Operations, Technical Features, Safety and Environmental, and Costs. The lengthy questionnaire is designed for completion by shipping companies to provide full details for each ship in the fleet. The topics are grouped under a number of headings, namely deployment, physical characteristics, performance at sea, crew, cargoes and costs.

This component of the project has not been directly applied to the case studies. However the transfer of knowledge from the naval architects in the consortium to other members has been useful, and it has informed their fieldwork. Undoubtedly this approach to reviewing the

[1] The annexes referred to in this chapter are provided in Appendix B.

characteristics of ships, as recorded in the paper and questionnaire, will have applications beyond INSPIRE.

5.2.3.2 Format for examination of ports

BEL has prepared a 23-page document, which is an introductory paper and an extensive check list attached as Annex 2. This aspect of the study is presented with the topics which an evaluation of a port is likely to include, organised under 16 divisional headings. Against these topics guidance notes are provided to indicate where the information is likely to be found, the unit of measurement used, the range limits of each, and other notes which may be helpful. The approach adopted has been that the information of most significance to any enquiry will vary from one port to another and from one study to another. Rather than risk rejection or an unhelpful response from port authorities or operating companies to a general questionnaire, which may be very lengthy or inappropriate, it is suggested that it is better to select from the checklist the topics for which answers are needed.

In respect to the work on WP4, the Ireland/Mainland Europe Corridor, it was identified by NEC that specific detail relating to ports and services using them was required. The extent of the data is shown in Annex 3 attached. The topics included are issues relating to navigation times to and from the berth, cargo working performance, inland transport links, charges and unit load services. These details were assembled for 41 European ports; the use to which the data has been put is shown in the report on WP4 below.

The output from Task 2 should be seen as an aide-mémoire for use beyond the confines of INSPIRE. Any investigation into the circumstances of a port, whether it be primarily from an operational, commercial, financial or engineering viewpoint could be a more thorough process through the inclusion of additional aspects prompted by the list in Annex 2.

5.2.3.3 Format for examination of cargoes

SIOS developed a questionnaire, attached as Annex 4, which is designed to generate a record of the inward and outward traffic flows of individual importers and exporters. A two-year period is provided for in order that the latest data is available while the earlier year can be cross-checked against published figures for the country, region or industry.

The four page questionnaire seeks to cover for the contributing company all cargoes moving monthly with a breakdown by commodity, cargo category and parcel size. For the main commodity groups routing, mode of transport and time factors are to be given. A main contribution from this section of the project is a simplified commodity classification, which is proposed. While established internationally recognised codings such as SITC and the 3 digit NST classifications are available they are comprised of many groups and sub-groups. SIOS have put forward a 14-category code C1 – C14 the details of which, with those of more complex options, are attached within Annex 4. For the purposes of INSPIRE this simplified coding is adequate.

As advised above the use of the questionnaire within the project produced a very low response rate. This may have resulted from the way that potential suppliers of information were approached; the gaining of active support through the supply of data from commercial entities is more dependent upon the way the request is introduced and sold than the format of any questionnaire that might be used. However the questionnaire as devised is recommended to others who may be seeking to derive comparable data.

5.2.3.4 VTMIS and safety matters

Marine Analytics of Rotterdam (MARAN) has compiled four separate papers to help progress the INSPIRE project. They are attached as Annexes 5-8. While the original objective was to provide a basis for the analysis of ship movements from open sea to the berth and vice versa, with particular emphasis on how that might impact on the commercial deployment of ships on routes in Europe, the scope was widened during the course of the project mainly as a reaction to the development of TradeStar and the need to provide data for it.

The first paper, Assessment Method for INSPIRE Demonstrators (Annex 5), sets out the steps that could be followed in the assessment of scenarios; the factors that should be addressed are identified with the recommendation that results should be compared with a control or reference scenario. The latter part of the paper is geared to a maritime environment such as those included in INSPIRE.

The second paper, Framework for Assessment of Different Modes of Transport (Annex 6), addresses the question of the mode and route choices taken by both freight and passengers. This is central to two of the three case studies in INSPIRE where cargoes to and from Ireland and Kaliningrad have some degree of choice as to whether direct sea routes only are used or not. The paper draws on the work of Akagi, the eminent Japanese transport economist.

The third paper, Cost of Transport by Ship (Annex 7) addresses many of the core issues that were set for this task within WP2. Port safety and the relationships between ship and fairway characteristics are reviewed in some detail, and equations for estimating the costs of delays to ships are provided and explained. Equations are also supplied to help in the derivation of various port charges that are levied against the ship such as pilots, tugs etc.

Finally a fourth paper is provided entitled Sustained Vessel Speeds (Annex 8). While the relevance of this paper to INSPIRE may be somewhat tangential the results are applied to three small lo-lo ships of the types deployed on shortsea routes within Europe. It is a practical problem for such ships to cope with rough weather and to make up time once a schedule has been disrupted. A major argument used by shippers to and from Ireland who favour the U.K. landbridge route rather than direct sea services is the assured journey time of the former route when compared with uncertainties in the Atlantic.

5.3 THE TRADESTAR SIMULATION MODEL

5.3.1 Summary

This chapter summarises the work done within WP3 of the INSPIRE project. The objective of the work package was the adaptation and modification of an existing software system called TradeStar for use within the case study work packages of the project. The report first details the aims and objectives of WP 3.

There follows a Technical Description of the TradeStar system. This description includes a functional outline, design details and information about key components. The modifications made to the system within the INSPIRE project are outlined.

There follows a description of the analysis methodology, which is the cornerstone of the TradeStar philosophy. However, due to commercial reasons only a top-level description of this aspect is described.

In conclusion consideration is given to future work toward commercialisation of the TradeStar system. The analyses undertaken by TradeStar in each of the corridor studies are reported upon in their respective work package appendices.
The complete WP3 report includes a discussion of issues arising from the experiences of the work package 3 team within the project. Arising from this discussion policy recommendations are given in chapter 7 and in summary these are:

- Software tools can make significant contributions to accelerating the integration of European transportation. There are however impediments to the development of such tools. In the research area potential collaborators must recognise that a conceptual gap *may* exist between those bringing a technology to a project and those who wish to utilise that technology.
- There is an issue of data sharing between research projects. Re-collection of the same data occurs frequently. Methods of making gathered data easily and efficiently available to other researchers are required at a European level. Such a system would facilitate more rapid progress in transport research.

Screen shots and data information for TradeStar are also included as Appendix C.

5.3.2 Objectives

The primary objective of WP 3 as set out in the technical annex may be stated as the development of a software model to simulate the commercial aspects of shortsea shipping that enable:

- Comparison of shortsea shipping with land based transport.
- Comparison of unitised shipping with bulk feeder services.
- Analysis of multi-port and port to port trading.

The system should enable comparison using any combination of the following alternatives:

- Road transportation.
- Rail transportation.
- Inland waterway transportation.
- Shipping transportation.

The comparison criteria should include:

- Time.
- Charges.
- Reliability (variance in time).
- Environmental Impact.
- Indication of the “better” routes by means of VOT[2].

[2] **V**alue **O**f **T**ime

For transportation between two locations the system should facilitate the use of:

- Alternative routings.
- Different vessels and land transport vehicles.
- Different fuel and other charges.

5.3.3 Technical description of simulation model

The TradeStar system is designed to facilitate accelerated analysis of large numbers of transport options. This is achieved by reducing, or removing entirely, the tedious tasks of data derivation, data entry and repetitive and time-consuming calculation of results. Analysis is simplified by means of a clear presentation of results coupled with the ability to compare options at a glance using various tools. The system is both flexible and modular allowing the addition of further evaluation criteria and techniques of analysis as and when required. Data entry is clear and unambiguous and a separate database application has been developed that can be distributed to third parties to facilitate offsite collection and entry of data. Graphical representations are used by means of a Geographical Information System (GIS) enabling easier visualisation of geographical context and transport alternatives. An overview of the functional design of the TradeStar system is given in Figure 5.

5.3.3.1 System design

The system design is based on previous work undertaken by WP3 partners outside the INSPIRE project. Within the project it was significantly enhanced to improve functionality, increase the level of automation and increase processing speed. The design of the TradeStar system is quite organic in nature as it is continually improved in light of changes in software technologies. However at all stages of development the design has been shaped by four principle objectives, namely:

- To permit the highest possible degree of flexibility for current and future evaluation criteria and analysis requirements.
- To avoid extended processing times thereby allowing the user carry out analysis in "real-time".
- To develop a design that would leave the broadest scope for future expansion.
- To facilitate future extended automation of the system.

A system such as TradeStar imposes significant challenges on a Design Team. Transport networks are inherently complex and large numbers of actors participate in them. An examination gives rise to a plethora of scenarios that must be taken into account during the design phase. From this plethora of scenarios a useful design must emerge that captures the generic and persistent features of transport networks in general. The design on which TradeStar is based is quite generic and serves to enable modeling of most transport scenarios. It is a pre-requisite that a system like TradeStar must be flexible to be of use and must also perform its tasks in reasonable time. This presents a conflict to designers. Flexibility often implies complexity and complexity results in longer processing times. The TradeStar design is a necessary compromise between these conflicting factors.

Not all the design changes made to TradeStar during the INSPIRE project were steps forward however. Issues with WP 2 and data collection necessitated modifications to the design on more than one occasion. These changes were made in an effort to counteract the potentially negative effects of missing or incomplete data sets. Some such design changes resulted in minor losses of functionality within TradeStar.

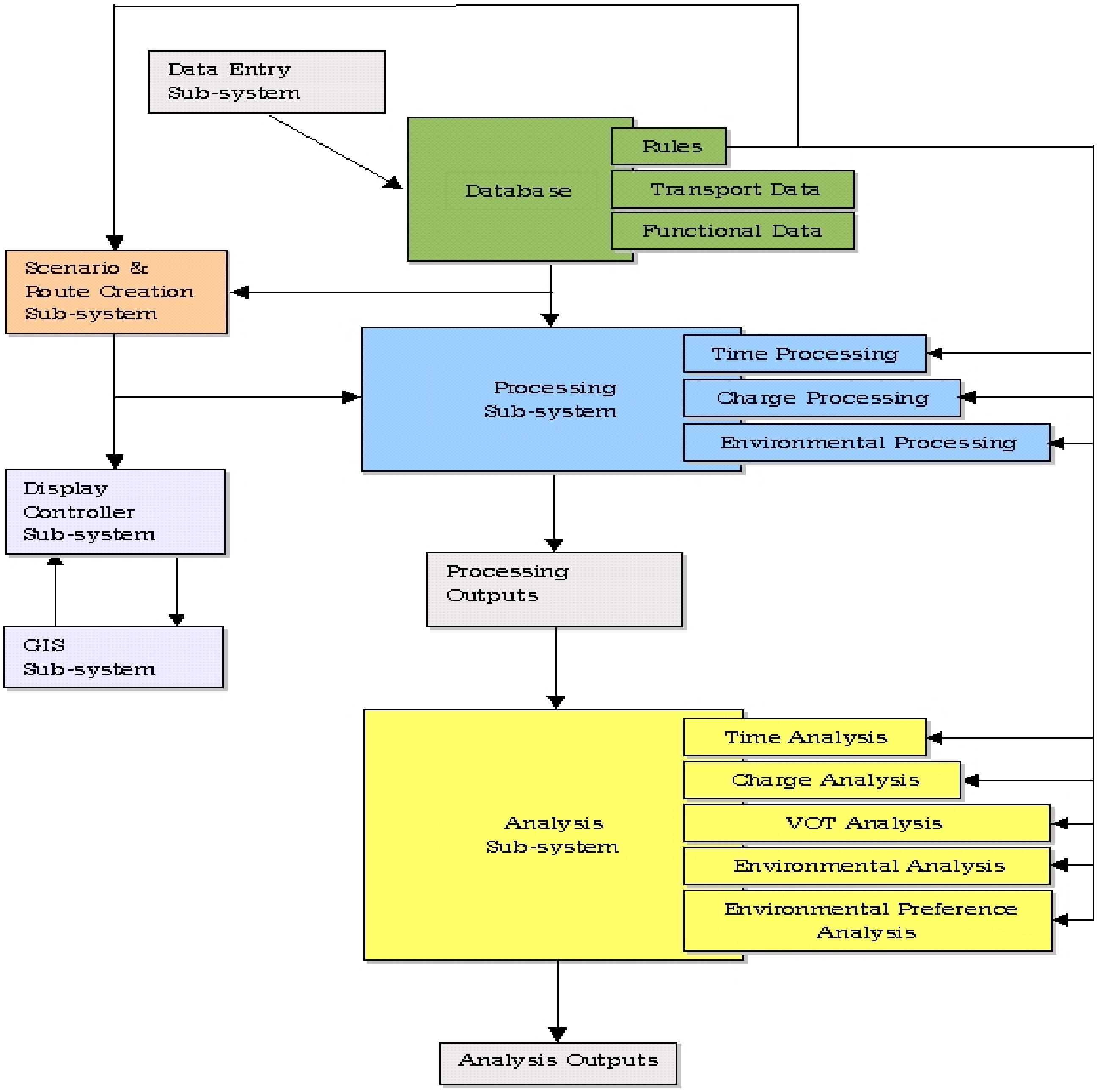

Figure 5: Functional design of the TradeStar system

The key design changes made to the TradeStar system during the INSPIRE project may be summarized as the:

- Re-design of the system database. This modification helped:
  - Make the system more flexible by replacing static data i.e. fixed values by "functional" data that could be used to compute values at run time.
  - Improve performance.
  - Reduce the amount of data required.

- Addition of a GIS. This modification helped:
  - Reduce the reliance on manually entered data.
  - Improve the users visualization of transport options.
  - Provide a simpler interface for the user.

- Addition of Rule based components. This modification helped:
  - Reduce the amount of data required.
  - Improve performance.
  - Make the system more generic.

- Modification to evaluation criteria functions. This modification helped:
  - Improve flexibility.
  - Improve performance.
  - Improve accuracy of calculations.
  - Add further analysis features.

The TradeStar system may be divided into 3 primary sections, which are described in the following:

Data sub-system

The system database, illustrated in Figure 6, forms the core of this section. Here all the data used by the system is entered and stored. During INSPIRE this section underwent significant modification. The database was re-designed and re-written and a GIS was added with its data managed in this sub-system. The database also stores the "rules" utilised by the system. These rules and other data are accessed by means of an access interface, which forms the bridge between this sub-system and the remainder of the TradeStar application. This is illustrated in figure 4. The system database is currently in Microsoft® JET® format and supporting code is written both in SQL and Visual Basic®.

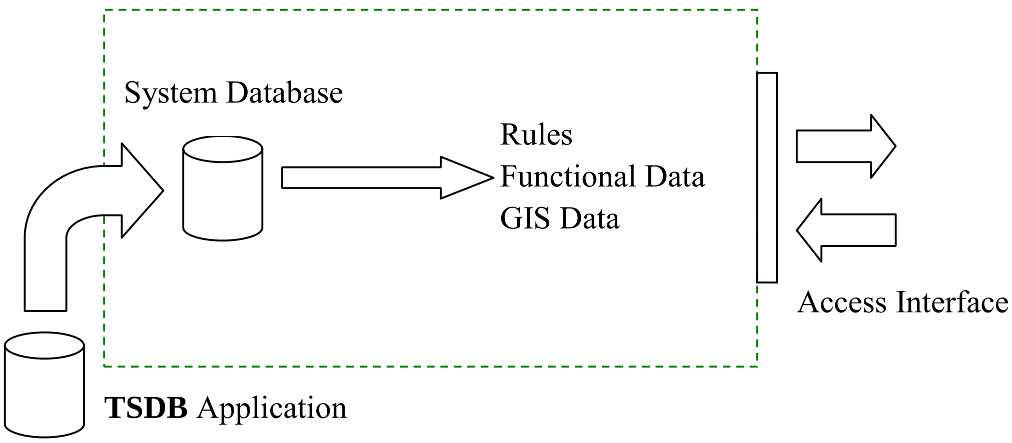

Figure 6: Data sub-system

A complimentary system, *TSDB*[3] was developed in order to facilitate more efficient data collection in a consistent format. Direct entry of collected data by the person(s) who collect that data removes two significant barriers viz.

- Multiple re-interpretations of data is avoided.
- If data is supplied on paper by those who collect it, it must subsequently be reprocessed and entered into a database by others resulting in additional work and increased chance of error.

TSDB contains a similar database to TradeStar. It was distributed to the INSPIRE partners in 1998 in an effort to improve the data collection process. Screen shots of the TSDB system are given in Appendix B.

Scenario and route sub-system

This section facilitates the construction of valid scenarios and routes, as illustrated in Figure 7. A scenario is a container for holding route models to be analysed. In order to facilitate valid analysis all routes within a scenario share certain common characteristics. These characteristics are origin, destination and the cargo unit that is being transported between these locations. A route is a means by which the cargo unit specified in the scenario is transported between the origin and destination. All characteristics (with the exception of the origin, destination and cargo unit) of, and all the actors that participate in a route can be varied. It is this approach that gives TradeStar its flexibility.

This sub-system also contains components to ensure the validity of routes entered into TradeStar. This validity checking is quite sophisticated and entails ensuring only valid transport modes, actors and connections etc. are entered by the user as they build routes. Extensive use is made of rules in this respect. Components also exist here for constructing, storing and retrieving scenarios and routes.

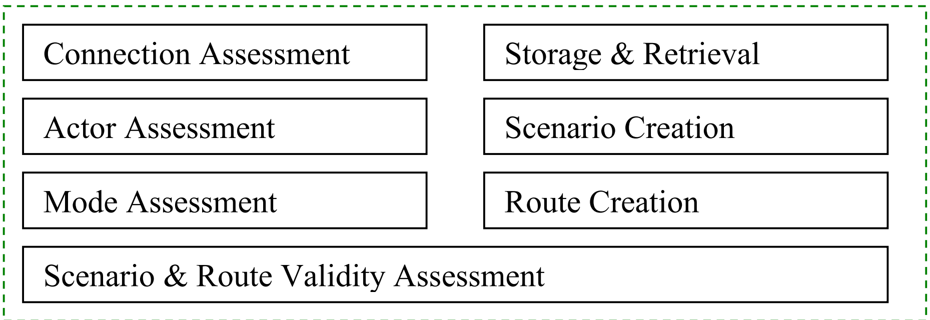

Figure 7: Scenario and route sub-systems

Once scenarios and routes have been constructed calculation must take place prior to analysis. The complexity of the calculations and hence how long they take is dictated only by what analysis is desired. The modularised nature of TradeStar is such that additional analysis capability (and hence computations) can be added with relative ease. In its present form, TradeStar is fitted with the ability to do time, cost, reliability, fuel consumption and value-of-time (VOT) calculations.

[3] **T**rade**S**tar **D**ata**B**ase

Successful calculation requires a careful division of transport routes into constituent components. The interfaces between these components must be precise, clear unambiguous and non-overlapping. Central to the effectiveness of TradeStar as an analysis tool is the manner in which routes are deconstructed.

Computation relies heavily on data and issues within WP 2 of INSPIRE meant this sub-system had to undergo several modifications during the life of the project. Many of these modifications reduced the accuracy and/or scope of the calculations thereby limiting the analyses that could be undertaken.

The overall time performance of TradeStar relies largely on the efficiency of computation. TradeStar now operates in real-time with calculations (and associated processing overhead) for one route[4] taking approximately 2 seconds[5]. Refinement of the computation methods is on going. An analysis of a typical scenario[6] takes approximately 11 seconds.

The analysis section of TradeStar permits comparison of entire routes and constituent route components based on time, charges, reliability, fuel consumption and VOT. Summary, detailed breakdown and ranked analysis is possible. Analysis is possible for FEUs, TEUs, 40' trailers, 20' trailers and bulk cargoes. There are no geographical limitations to the system subject to available data. Both existing transport services and "virtual" services can be analysed side by side. Analysis is presented both in textual and graphical form.

The TradeStar design incorporates the ability to carry out analyses of point-to-point and cycle scheduling for ro-ro and lo-lo services and analysis involving cargo flows. This functionality has not been fully implemented for the INSPIRE project as insufficient data was available to utilise these features. In other work these features are now being incorporated.

Display and user interface sub-system

The display system and user interface of TradeStar consists of many component parts. Many of these are standard to Windows programs but several had to be specially constructed for TradeStar i.e. the module used for displaying routes and for enabling graphical addition of route components.

The user-interface of TradeStar has undergone many changes prior to and during, the life of INSPIRE. As the system evolves so does its look to the outside world. From a command line interface in 1993 to its most recent incarnation with a GIS system TradeStar has improved how it presents the complex and involved actions necessary to carry out transport analysis. Providing a clear understanding of transport networks with all their associated actors, charges, times, schedules, etc. is difficult. While progress has been made work will continue in this area.

The most obvious advancement made to TradeStar in the course of INSPIRE was the addition of a GIS. This enhancement has the very desirable effect of improving the user visualisation

[4] for a route such as Cork---Dublin---Liverpool---London---Folkstone---Calais---Paris
[5] P300, 200mB RAM, Windows NT 4 Workstation
[6] Consisting of 5 routes as described in 4 above

of transport options. This was very effectively demonstrated at the TradeStar workshops[7]. While not an essential to the functioning of TradeStar the inclusion of a GIS was considered very important by the WP 3 team to maximise the benefits the INSPIRE project would reap from its use. The time and cost required to implement the GIS were not available within the WP 3 budget so the costs were borne internally by the WP 3 co-ordinators [NEC]. Many of the extremely powerful features of GIS remain to be implemented and this work will be undertaken post INSPIRE.

In software used by experts for research the user interface is not of primary importance. The budget and time allocated to WP 3 reflect this. The sums and time required to develop a commercially acceptable user interface are substantial. Progression toward commercialisation of the TradeStar system will require this injection of capital.

5.3.3.2 Programming technologies & environments

The model was developed using *Visual Basic®* within the Microsoft® *Visual Studio®* Integrated development environment. Database functionality is provided using the Microsoft® *JET®* technology and the *SQL* language. The GIS tools developed are based on MapInfo® *MapX®* technology and the mapping data in use *is Global Insight Plus®* as supplied by Europa Technologies®.

5.3.3.3 Platforms

Currently TradeStar run on the following Win32 based operating systems:
Windows 95®, *Windows 98®* and *Windows NT 4®*

5.3.4 TradeStar Analysis Methodology

The analysis methodology used in TradeStar does not have its origin in any one aspect of transport network research. Indeed part of the uniqueness of the methodology is that it endeavours to integrate the benefits of many disparate approaches[8] while placing them firmly in a practical and real world context. The TradeStar methodology is commercially sensitive for its authors and hence a detailed explanation of the approach is not given here. What follows is an outline of the approach in general terms.

5.3.4.1 Analysis approach

TradeStar functions by means of comparative analyses. Within the context of a transportation requirement between two locations two or more “routes” are compared to each other by application of the criteria of time, cost, reliability, environmental issues and VOT appropriateness.

A “route” is simply any valid means of transporting goods between two locations. The concept of a route encapsulates the use of differing paths between origin and destination, the use of differing transport modes, vehicles, speeds, fuel prices etc. Consideration of this concept leads quickly to the realisation that the number of valid routes in any situation is theoretically infinite. Within the INSPIRE Project the selection of a manageable number of

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[7] A week of workshops held in Dublin, Lisbon and Barcelona in early 2000.
[8] For example the Akagi method.

"reasonable" routes to examine using TradeStar has at all stages been left to the expert user[9]. The question of the assessment method used to identify routes to be considered is discussed in the following section.

Routes to be compared are grouped together within a framework called a "scenario". All routes in a scenario share a common origin, destination and unit of cargo being transported. This enables a valid framework in which comparisons can occur, as illustrated in Figure 8. For a valid comparison two or more routes are required.

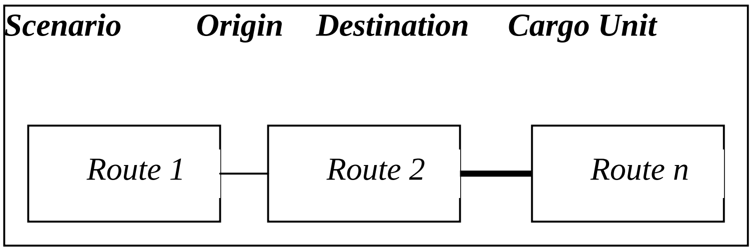

Figure 8: Route analysis approach

5.3.4.2 Assessment method

The assessment method is particularly important with respect to two aspects of TradeStar use namely:

- The decisions made by the expert when determining what routes to examine.
- The interpretation of the results of an examination.

The assessment method is suitably described in a paper prepared for the INSPIRE case study partners[10]. This paper has been re-produced in part and paraphrased for the purposes of this document.

An assessment of a route or routes is made within a particular scenario and results cannot be assumed to be valid outside that scenario. A route defines the situation within which an assessment is being made, i.e. a route embodies an assessment. A route therefore embodies many of the assumptions made in the assessment process. (Other assumptions arise in the selection of data and in the relationships that may be assumed between the factors).

The context of a route involves a description, which includes but is not limited to:

- The area considered in geographical and hydrographic terms.
- The vehicles used.
- Navigational and other features of the area.
- The physical features of ports & terminals etc.
- The organisational features of the area, the ports & terminals as well as those of the transport chain.

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[9] Work is underway to automate the removal of at least some routes that are theoretically possible but non-sensical or impractical.
[10] MARAN. "Assessment Method for Inspire Demonstrators". 1998.

Information contributes to a route definition. The characteristics of a route depend on:

- Quantity of information.
- Quality of information.
- How the information is utilised.

The framework for route definition also enables the assessment process to be accurately described. Figure 9 illustrates the process in its basic form as follows:

- Ellipse 1 depicts those parameters of factors which are relevant to the assessment process (as input and output parameters).
- Ellipse 2 depicts the values given to the input parameters. These may be considered as constant or are allowed to vary (as a controlled variable).
- Ellipse 3 depicts the relationship between input and output parameters.
- Ellipse 4 depicts the process of applying the value from Ellipse 3 to produce a result (values for the output parameters).

A further variation may be identified where use is made of a reference route. This is shown in Figure 9 as Ellipses 5 and 6:

- Ellipse 5 depicts the reference route parameters and associated values. These values relate typically to existing situations.
- Ellipse 6 depicts the process of selecting and interpreting values from the reference route to be used in the assessment route.

These general concepts may be used for a macroscopic type of assessment. Generally, a typical macroscopic approach uses reference routes. These routes are selected as being representatives of the route for the assessment itself. Representative factors may be the relevant distances and the cargo flows. From these representative scenarios numerical values may be derived to be used in the assessment. The form of the relations is assumed to be valid for the assessment route as well as for the reference routes.

Since the numerical values of the parameters are known, the calculation for the assessment routes can be carried out using the values of the reference route to the form of relationships established in the assessment process. The results can then be evaluated in order to make a final decision with respect to the assessment route. Critical factors in the macroscopic approach are:

- Selection of reference routes, in particular the criteria used to obtain representative features.
- Selection of numerical values for the parameters of the reference routes.
- Relations between the parameters used in the assessment, which often hide important assumptions, thus limiting the validity of the results.

The major types of output of macroscopic approaches of assessment are related to the costs and reliability of the services provided.

The results may be used for decision making and the selection of other options, which may seem to be competitive.

A limitation of the results is caused by the degree of reality of the assumed relations between the variables used in the process definition. This limitation is, however, shared by all other methods of assessment, where relations between variables are assumed to exist.

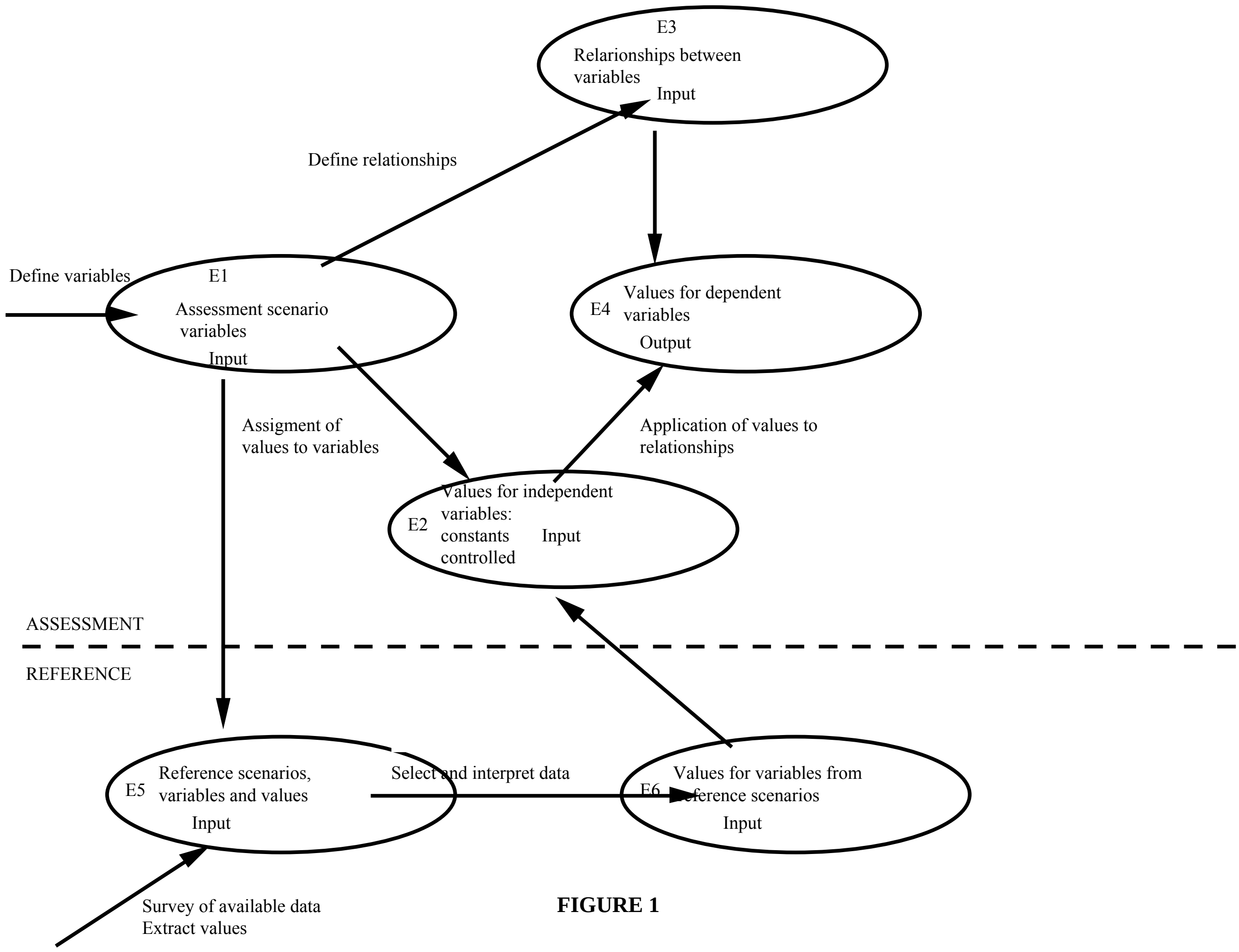

Figure 9: Assessment method

5.3.5 Future Work

The WP 3 co-ordinator is already pursuing the commercialisation of TradeStar. Much work remains to be undertaken to advance the system from an experts research tool to a fully viable commercial application. Automation work, incorporation of a more sophisticated user interface, additional capabilities, inclusion of Internet capabilities and further modularization are only some of the tasks facing the developers.

The sphere of application of the system will be expanded to encompass the broader transport sphere as integration permeates the industry. A family of systems is envisaged that will embrace:

- Transport providers.
- Infrastructure providers.
- Operators.
- Facilitators.
- Planners.
- Researchers.
- Transport end users.

The nature of the TradeStar system and the computer science technologies used (drawn from fields that include Artificial Intelligence) means a significant proportion of development resources will always be focused on research. This is in order to keep abreast of developments that will occur in both the computer science and transport fields.

5.4 CASE STUDIES

This section summarises the work performed in the four INSPIRE case studies, Ireland, Portugal, Spain and Russia. It is referred to Appendix D for the summaries of the four case studies. Additionally, it is referred to Appendix E for the background to the Irish case study, Appendix F for the background to the Portuguese case study, Appendix G for the background to the Spanish case study and Appendix H for the background to the Russian case study.
The case studies have functioned as input of knowledge and experience to the development of the INSPIRE methodology, which is described in Section 5.5. The methodology is the generic and transferable deliverable from INSPIRE.

The corridors have widely different characteristics and the data availability have also varied. The results from the case studies are therefore of various degree of completeness with respect to utilising the results as background for initiating shipping services on the corridors. However, there is certainly scope for implementation of some of the results, which may lead to innovation. The INSPIRE project has not had time or resources to investigate the innovations in details and this should be targeted in further work.

The case studies have resulted in ship designs for the various routes, and whilst only speed and capacity is reported upon in this chapter, concept designs are provided in Appendix I.

5.4.1 Ireland – Northwest Europe

Ireland’s island location is on the western rim of a European Union that is expanding to the east and likely to continue this expansion for many years to come. As an island Ireland remains without a rail or road link to the UK or mainland Europe and it is therefore dependent on waterborne transport either through direct sea services or via land bridge across Great Britain for its imports and exports. Because of its peripheral location the cost and transit time factors in getting cargoes to and from Ireland is of vital importance if it is to maintain competitiveness.

The Republic of Ireland’s current booming economy has seen a significant increase in trade and this growth is forecast to continue at an estimated 6% per annum over the next 7 years. While the Republic of Irelands ports have improved in a significant way with the help of EU structural and cohesion funds, land access to some ports, particularly Dublin, remains a problem and projects have been agreed which are intended to relieve congestion. Ireland’s physical public infrastructure lags significantly behind other EU member States. The Irish Government plans to address this problem by investing circa 50 million Euro in a range of projects over the next six years.

The primary objective of WP4 has been to develop an innovative strategy that will enhance the competitiveness of direct shipping between Ireland and mainland Europe.

A significant portion of the trade is bound for/from NW Europe using Great Britain as a land bridge and making a major contribution to congestion on its roads. The brief for the corridor study is to investigate how the direct short sea shipping option between Ireland and NW Europe can be made more attractive. The means for such shipping services comes through the use of vessels that are currently available on the market and the use of innovative vessels that may be radically different in size, speed and design.

The research estimated that 540,000 HGV/containers is the annual flow of Ireland's international trade that uses Great Britain as a landbridge to access markets in mainland Europe and the rest of the World. This figure represents approximately 40% of the total unit load carriage to and from Ireland and almost 70% of the total between Ireland and mainland Europe. Given the booming Irish economy the volume of this through traffic is probably growing at about 6% p.a. This estimate, if correct, would double the number of transit units by the end of this decade.

The adverse effects on the environment of this growing problem are obvious. There are serious implications for traffic congestion, air pollution and noise. The average fuel consumption for a HGV transiting the Great Britain landbridge is estimated at 130 litres of diesel. In this respect, the total land based fuel consumption amount today to 70 million litres per year, which rises to more than 140 million litres per year by the end of this decade, if the projected growth figures are accurate. Much of the projected fuel usage could be eliminated by adoption of direct sea routes.

WP4 has a strong focus on shippers and receivers, particularly in trying to identify more closely their needs in terms of cost and time for getting goods to mainland Europe. The core objective of the WP4 team was to look at the possibility of displacing some of the landbridge cargo by examining the existing situations of real shippers and receivers and then simulating idealised scenarios, using TradeStar, on the basis of cost, time and the impact on the environment.

Two companies, Glanbia plc and Queally Group, with extensive export shipping requirements, agreed to participate more fully in the project and were selected for analysis using the TradeStar model. The analysis and results show that a modal shift is possible from landbridge to direct sea routes, however such a shift will be difficult because of well established and reliable services in the Irish Sea between Great Britain and Ireland.

The results illustrated that a shipping system using a combination of ro-ro and lo-lo ships will provide a competitive service on the Ireland – Continent route accommodating a wide range of the present market requirements. In this respect, two conceptual ship designs have been developed, as illustrated in the appendix, which accommodate the present market requirements:

- A 21 knot cargo ro-ro vessel.
- An 18 knot open-hatch lo-lo vessel.

The report suggests that both RoRo and innovative fast LoLo have a role to play in attracting shippers to use direct sea services. The RoRo options examined include conventional, IPSI and FastShip concepts. The open hatch containership concept has much to offer but has an operational cost disadvantage because of higher tonnage measurement when compared with a conventional vessel of similar TEU capacity.

INSPIRE research indicates that cost effective direct services are possible. The key to success lies with cargo owners; they have to be convinced that reliable services can operate to set sailing schedules with sufficient frequency to guarantee the required door to door transit times. A significant proportion of landbridge cargo is moving across Great Britain by road because it is the easy option with reliable and frequent sailings. A major marketing exercise coupled with a pilot project is required if a significant move to direct services is to take place. With forward planning, or supply chain management, it is also probable that some shippers could live comfortably with increased door to door transit times on reliable lower cost direct LoLo services. TradeStar analysis also demonstrates that fast direct and competitive services can match the existing landbridge services. The negative impact from road transport on the environment is significant and growing steadily, and using more waterborne transport can reduce this aspect.

It is concluded that it behoves EU, National, regional and local authorities, and all relevant industry organisations to consider the downside and negative consequences of not rising to the challenge facing all concerned. By the end of this decade it is estimated that over 1,000,000 HGV/containers will be transiting the Great Britain landbridge between Ireland and Europe. The report makes recommendations that should help to bring about the desired modal shift from landbridge to direct sea routes.

At the time of writing it has come to the notice that a new direct service is about to commence between Rosslare in Ireland and Brest in France. Preliminary details available indicate that the vessel will make three roundtrip sailings per week and vessel speed is 20/21 knots providing a passage time of 14 hours. The proposed vessel is said to have a capacity of 44 HGVs and the main export trade being targeted is livestock.

The introduction of this type of service is very much in line with the conclusions and recommendations of INSPIRE, and specifically the Irish case study. It also serves to demonstrate some operators and cargo owners believe that fast direct services can compete with the Great Britain landbridge transit crossings. While the proposed service may be quite small in terms of vessel capacity and frequency of sailings, it should be interpreted as a positive signal for further development if all the recommendations for the corridor study are taken seriously.

5.4.2 Portugal – Madeira/Azores

The Portuguese case study is a very specific case study, as the mainland and the islands are respectively peripheral and ultra-peripherals regions of Europe. The Portuguese Islands have always suffered from the lack of communications and isolation from the mainland. Portugal itself is a peripheral region of the Europe, which give more emphasis to use short sea shipping trading with other European countries.

The case study has emphasised on the need to integrate, or adjust, the corridor between the mainland and the islands with the trans European intermodal networks being developed in order provide better integration of these peripheral and ultra-peripheral regions in Europe. The aim of the case study was to develop innovative solutions for Portuguese trade corridor and to improve the current situation, which is based upon an old monopolise trade pattern linking Madeira and Azores islands with Lisbon and Leixoes. The strategy identified in the work was one of creating a network, where several trades are integrated in such a way that a rebalance of unitised cargo is made. On this background a new shipping system is suggested:

- A coastal feeder system between Lisbon and Leixoes feeding Lisbon with island cargo, which also can accommodate the present road traffic.
- The islands are served directly from Lisbon, reducing transport time.
- Overseas liners, destined for the large European container hubs, pick up empty containers.
- Improve management of the trade and co-ordinate export/import between mainland and islands.

The shipping system is suggested served by a combination of ro-ro and lo-lo ships, as described in the appendices and briefly in the following:

- There is movement of containers from Northern Europe, namely Rotterdam to Portugal, where there is an imbalance in trade and as a result the number of empty containers to be repositioned back to Rotterdam is large.
- The empty containers coming out of the North - South Trade from Rotterdam can be used in the feeder trade to the Madeira and Azores islands where again there is an imbalance in trade, as today empty containers are returned to the mainland. To reduce costs in this trade it is proposed that the feeder ships do not carry empty containers on the return voyage to Portugal, although there must be movement of empty containers in the Feeder Azores Trade between Ponta Delgada (São Miguel Island) and Praia da Vitória (Terceira Island).
- Because empty containers do arise for lack of returning cargo to Portugal, and because containers must be repositioned in a port where cargo is consolidated, it is proposed that:
    - The ships operating in the Trade Europe - Africa call in the Madeira Islands to reposition the empty containers in Rotterdam,
    - The ships operating in the Trade Europe - South America call in Praia da Vitória, Terceira Island of Azores Archipelago to reposition the empty containers in Rotterdam.

The proposed ‘triangle’ (Rotterdam, Portugal and Madeira/Azores) system may solve the problem of repositioning empty containers. This contributes to a reduction in the costs arising from the movement of containers as well as in costs concerning the hiring of containers. Due to this situation, it is proposed that shipping companies operating in this network should make agreements towards the interchange of containers.

To create this innovation new ships and cargo handling systems should be employed and the ports' infrastructure must be improved. The benefits are mainly from a cost point of view, since the delivery times are not so much altered from the current trade scenarios, as the time factor has been identified to have low priority in the island trade.

The effects of establishing the new transport system will be beneficial to the islands, as it will:

- Allow the employment of bigger ships in the trades.
- Provide lower and more efficient turnaround times in port due to the investment in gantry cranes.
- Assure transport services and trade with other countries, which may result in an increased GDP per capita.

Lo-Lo ships currently serve on the trade between the mainland and the islands and it is suggested that this ship type should be used in this trade in the new system as well. This is justified by the small demand for fast delivery of cargo to the islands and that cost is the dominant factor.

The proposed shipping system also included a new coastal route between Lisbon and Leixoes and it is suggested to utilise ro-ro cargo vessel on this route in direct competition with road transport. The distance by road between Lisbon and Leixoes (Porto) is 355 km, and by sea 325 km. The sea voyage therefore offers a distance saving of 30 km and consequently a potential for reduction of tonne-km and passenger-km. It is estimated that there are in excess of 300 trucks regularly employed on the roads between the two cities. Based on each truck achieving three roundtrips per week on average (i.e. 1,800 road goods vehicle movements per week) this implies at least an estimated 93,000 vehicle movements per annum. As the ports of Lisbon and Leixoes serve the two largest metropolitan areas in Portugal - Lisbon and Porto - with populations of 3 million and 1.5 million respectively, the actual volume of road traffic is believed to be much greater than this. The INSPIRE project has identified this corridor as a very good candidate where a modal shift from road to sea can be realised.

The main reason for selecting ro-ro vessels on the coastal route is the market demands for unitised cargo between the two main cities in Portugal with regard to time, regularity, flexibility and frequency, as this route will be in direct competition with road transport. These demands are better accommodated by the ro-ro concept.

Following the establishment of such a coastal feeder route, it is suggested that Lisbon is made the hub for the trade with the Madeira and Azores islands. This scenario will improve the logistic effectiveness of the island trade and savings in time and cost are foreseen.

The analysis performed illustrates that the coastal feeder route, on its own, may be competitive with current road transport, but further work is required in this respect. It is suggested to utilise 20-22 knot ro-ro ships having 2000-2500 lane meters to operate this route and conceptual designs are included in the appendices.

5.4.3 Spain – Canary Islands

The Spanish case study considered the corridor between the Spanish Peninsula and the Canary Islands where the state-of-the-art has been analysed in depth for the relations between the Spanish Peninsula and the Canary Islands regarding trade and fleet.

In the last decades the Canary Islands has been a consuming market and dependent on imports from the Peninsula, which highly overpass local exports from the Islands. The geographical position of the Islands requires a unique possibility of maritime trade for commodities and air travel for passengers. However, there are currently many restrictions and bottlenecks to be improved for the maritime trade.

In order to improve trade to and from the Canary Islands, the case study has considered two scenarios under various conditions regarding route, vessels, speeds, schedules, etc., which has also provided experience and knowledge to the methodology development.

The first scenario considered fruit export from Lleida to the Canary Islands. The current transport route is from Barcelona to the Canary Islands with intermediate calls in Valencia and Algeciras and this route is served by a number of companies offering a significant overlap in transport services. The analysis considered road transport to a number of ports along the coast in order to illustrate the effect of road versus ship transportation.

The results illustrated that the use of a 25 knot lo-lo cargo ship directly from Barcelona to Canary Islands was the best option considering time, costs and environmental issues. Such a service does not exist today and will form a tailor-made system for fruit exports from Lleida. A problem for such a service is the return cargo from the islands back to Barcelona, as the islands do not produce significant volumes of export cargo. The creation of an Economic Zone in the Islands and its selection as a hub port for Europe/America/West and South Africa will hopefully improve this situation.

The second scenario considered transport in a wider perspective, where innovations in the shipping system between the Peninsula and the Canary Islands are suggested:

- The use of ro-ro vessels between Cadiz and the Canary Islands in a tight schedule in order to satisfy the requirements of the shippers. It is suggested using three ro-ro vessels at 25 knots having each a 2800 lane metre capacity and using 48 hours on a roundtrip. The particulars of these Ro-Ro vessels, with ample hold capacity, can be loaded and discharged faster than smaller vessels, reducing not only the time in port but also the cost of call and the high cost of stevedoring. The suggested ro-ro ships are innovative and a conceptual design is included in the appendixes. This scenario alternative can be very well combined with the second scenario, which is described next.
- The use of a coastal ro-ro service in direct competition with road transport between Barcelona and Cadiz, which could carry cargo bound for markets along the coast and for the Canary Islands. The results illustrated that a 20 knot cargo ro-ro ship may be more competitive than road transport. The ship service is cheaper and takes only marginally longer time and the environmental savings are considerable. A suitable ship on such a coastal route will have the same conceptual characteristics as the ro-ro ship developed for the Irish corridor. A daily service is suggested, which requires 3 ships to be employed in the trade, having 2800 lane meters available. In order to initiate such a service work is required to attract cargo owners to utilise the service. The background for such a service is that the east coast road system in Spain is very heavily used. The total freight traffic moving by road between Catalonia and southern Spain amounting to an estimated 6.4 million tonnes per annum (1995 levels), equivalent to approximately 425,000 full heavy goods vehicle movements (Statistics Yearbook 1996, Ministerio de Fomento).

The second scenario aims to serve a larger market than only fruit exports from Lleida and further work is required to identify the market potential for unitised cargo on these routes. The coastal ro-ro route will be in direct competition with road transport and preliminary analysis is positive.

Several innovations have been studied in these scenarios, such as fast vessels, ro-ro and ro-pax. The results show that long road hauling option is faster, but restrictive regulations are increasingly being introduced, which will eventually increase the transit time for this mode.

Additionally, new environment policies will be introduced that will negatively affect road transport, such as for reducing atmospheric pollution, noise etc. On this background, competition between road transport and shortsea shipping is growing, and the way forward for the shipping industry is to improve through offering intermodal services to their customers.

The Spanish case study has shown that shortsea shipping will only be attractive to the user if there is a clear advantage in terms of a saving in time and money. Any reduction in delays in ports will have to be worked by changing the load/unload schedule, reduction/suspension of Customs formalities and clearances, 24-hours opening hours, improvements in ICT utilisation, avoiding paperwork, etc. Each interface is translated into time and money. Short Sea Shipping has too many interfaces in port already, such as hauling land transport, marshalling area, loading and unloading operations, lashing and securing on board. The same operations have to be carried out at both loading and unloading ports together with delays due to Customs inspections and red-tape. If these handicaps for shortsea shipping can be reduced, or even eliminated, the future may be bright indeed.

The improvement of the maritime trade and its infrastructure between the Spanish Peninsula and the Canary Islands and the promotion of shortsea shipping in Spain is a social and economical need.

5.4.4 Russia – Northwest Europe

The Russian case study concerns the improvements of the Port of Kaliningrad in order to make it more competitive and attract Russian destined cargo, which today is transported through the ports in the Baltic countries (Lithuania, Latvia and Estonia). The case study has described the current transport routes between Russia and the EU, which are benchmarks for any route via Kaliningrad.

Preliminary surveys at the initial stage of INSPIRE allowed the assessment of a wide range of cargoes. These analyses resulted in identifying the containerised cargo segment as the most promising for the Kaliningrad transport region. The TradeStar program was used for evaluation of the factors that directly and indirectly influence the cargo flows through the region.

The INSPIRE project has helped the enterprises of the Kaliningrad transport complex to identify their positions in the Baltic market.

The organisation dealing with the transport complex within the Kaliningrad administration is currently co-ordinating their activity in order to develop a common transport policy. The main tasks are the following:

- Elaboration and realisation of co-ordinated transport policy in the Baltic transportation market.
- Representation of the interests of members of the transport complex organisation in the state organs.
- Preparation and execution of long term development programs for the Kaliningrad transport juncture.

- Realisation of joint strategic surveys of the export and import market and consequently elaboration of suggestions on co-ordination of tariff policy for the enterprises of the complex.
- Elaboration of a joint PR program to promote the Kaliningrad transport juncture.
- Consolidation of resources in order to develop business plans pertinent to Kaliningrad transport infrastructure development projects.

The INSPIRE project results was delivered at the international transport conference Trans-Russia 2000 held in Moscow in May 2000. Representatives of Russian transport ministries and departments (including Minister of Transport Mr. S. O. Frank) and regional transport/forwarding companies were among the conference participants.

The results show that the Port of Kaliningrad has the potential to become a container terminal for Russia if investments in terminal, VTS and service facilities are made. There is also the question of improving management and marketing of the port.

5.5 THE INSPIRE METHODOLOGY – A TOOL FOR SSS INNOVATION

The generic and transferable outcome of the INSPIRE project is the methodology and this chapter describes the methodology and its components.

The INSPIRE methodology has been developed on the background of the four case studies, which has provided input and experience to the work described in this chapter. It is worth mentioning that the four corridors are very distinct in terms of issues being studied and the available data, which illustrates the flexibility of the INSPIRE methodology.

The methodology is a tool for innovation and it is referred to performing shortsea shipping developments the INSPIRE Way, as the way forward. The basic constituent of this methodology is the development of ship designs or shipping routes based upon market demands.

The INSPIRE methodology is a result of several years of research and maturing and the reader is reminded that a maturing process is needed in order to fully understand the process behind the INSPIRE methodology in order to make it a working tool.

The results from the case studies illustrate that the methodology is a valuable tool in order to:

- Decide ship type and speed on the corridor.
- Decide shipping scenario on the corridor.
- Analyse effects of infrastructure investments.

The application of the methodology, as performed in INSPIRE and presented herein, is a demonstrator and more work is required in order to tune and further enhance the methodology by applying it in industrial projects. This aspect is underway at the INSPIRE partners.

5.5.1 The INSPIRE methodology

The INSPIRE methodology, as illustrated in Figure 10, is centered around a shortsea shipping knowledge base that contain information about ships, ports, hinterland, cargo movements and hydrographics on the trading corridor in question.

In order to improve the logistic efficiency and ship, port and hinterland operations, implementations of standard information technology (IT) are given special attention. The information is collected by way of published statistics, literature search, questionnaires, interviews, etc. The information is structured and enhanced in the knowledge base in such a way that it may assist ship designers, service providers, and other industry players in their work.

General knowledge on historical developments relevant for shortsea shipping and major trends in technology and economy is gathered by performing strategic analysis in order to understand the situation today and anticipate possible trends for the future.

In this respect, two types of scenarios are present:

- Scenarios for the big macro picture, focussing on possible trend shifts and structural changes in the economy with implications for shortsea shipping.
- Strategic scenarios for the route in question using the knowledge base and based on the macro scenarios and the specific knowledge on ships, ports, and cargo movements.

This enables choosing a specific route and specifying all the logistic requirements for the transportation system. Adding a set of design criteria, the design process can start, ensuring that the resulting vessel has been optimised to fit a specific logistic task.

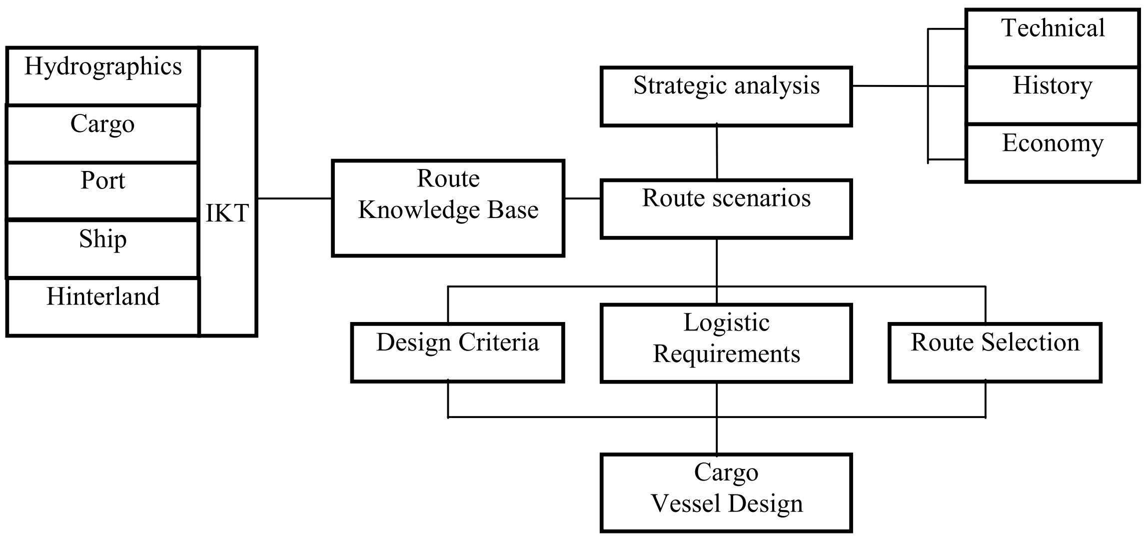

Figure 10: A methodology for shortsea shipping corridor studies

5.5.2 Strategic analysis

This sub-section utilises a strategic analysis of waterborne transportation as an example to illustrate the application of strategic analysis in the early stages of a development process. A full strategic analysis of European shortsea shipping is given in the appendices and only a brief summary of the process is outlined in this chapter.

A strategic analysis can be used to address the logistic requirements for the route or transportation system in question. The decisive aspects will vary according to customer demands and the value of cargo. In a wider context, the strategic analysis tool transfers operational knowledge back to the early design phase providing decision support throughout the design process and it should be utilised prior to any market studies on specific routes. The aim is to acquire the 'right' knowledge in the early design phase in order to develop vessels suited for the route or trade in question, which satisfy the needs and requirements in the operational phase. This is a scientific approach ensuring that supply matches demand.
The various steps in the strategic analysis are presented starting with a description of the internal and external environments. The strengths, weaknesses, opportunities and threats (SWOT) faced by the industry are pinpointed and analysed. On this background, strategic choices are made and long-term objectives and a grand strategy are selected. Finally, the strategic analysis is implemented in a formalised design methodology and conclusions are drawn.

5.5.2.1 Strategic analysis methodology

The strategic analysis methodology is illustrated in Figure 11 and described in the following using waterborne transportation as an example. The strategic analysis is initiated by investigating the internal and external environments where strengths, weaknesses, opportunities, and threats are determined. These factors are weighted and evaluated through a SWOT analysis matrix to identify a strategic direction and to form a possible strategy, which is used a basis to select a grand strategy. Adopting a grand strategy leads to specification of long-term objectives as well as focal areas and influential factors that need to be covered in order to make the strategic choice succeed. It is also argued that such a grand strategy must be developed in close liaison with the industry in order to foster better understanding of the decision making process that leads to the grand strategy selection.

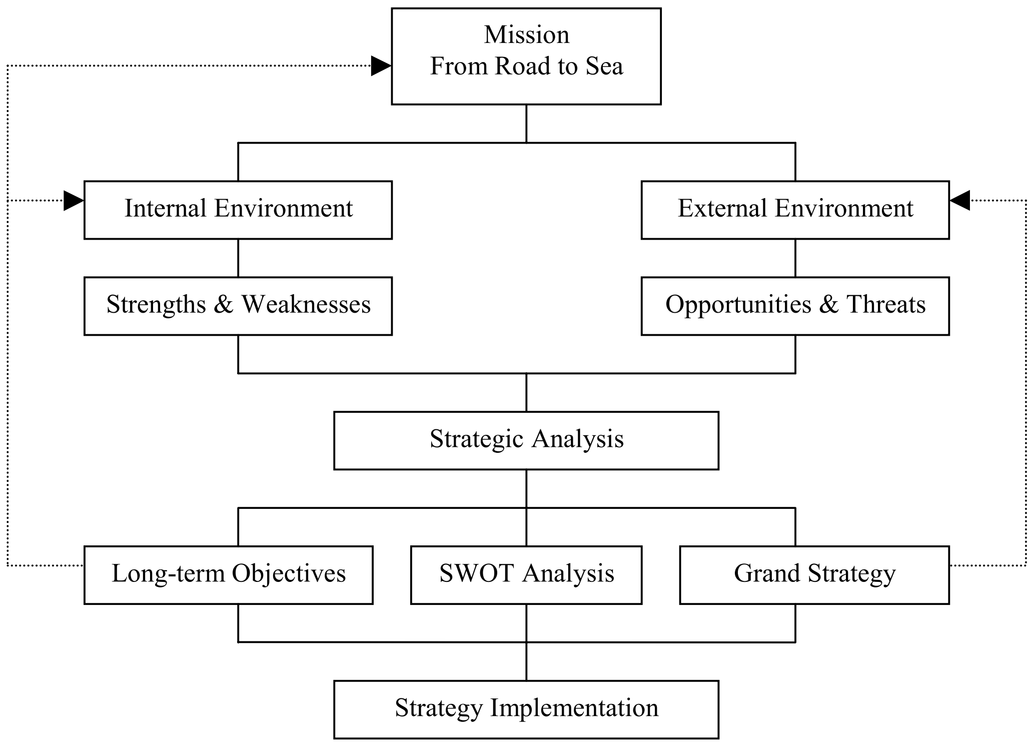

Figure 11: Strategic analysis methodology

5.5.2.2 Waterborne transportation

Waterborne transportation has always played a vital role in the European economy. However, road transportation has in the last decades improved the market share for unitised goods mainly due to the better logistics on offer by road haulage companies. The road infrastructure in Europe is ever improving, which is in a sense a hidden subsidy to the road industry.

The aim of recent emphasis on waterborne transportation has been to move cargo from road to sea. It is argued that the only way to achieve this is through technical solutions that are applicable in a larger logistics or regulatory system. Waterborne transportation must therefore be understood as part of an intermodal transportation chain where the ship is only one mode among several others, as illustrated in Figure 12. Even though the waterborne transportation industry must target development in the whole chain it appears that emphasis should be placed on information and communication technologies and cargo handling systems in order to be competitive with other modes of transport.

The waterborne transportation industry must satisfy criteria for customer satisfaction related to frequency and reliability of ship sailings, time and costs of voyage, environmental impact and political acceptability of the industry as a whole. The contribution from the waterborne transportation industry to the community should be understood as to improve transport resources by increasing the efficiency of the transport chain modes, be cost-competitive, improve intermodality, and offer safe and ecologically friendly transport.

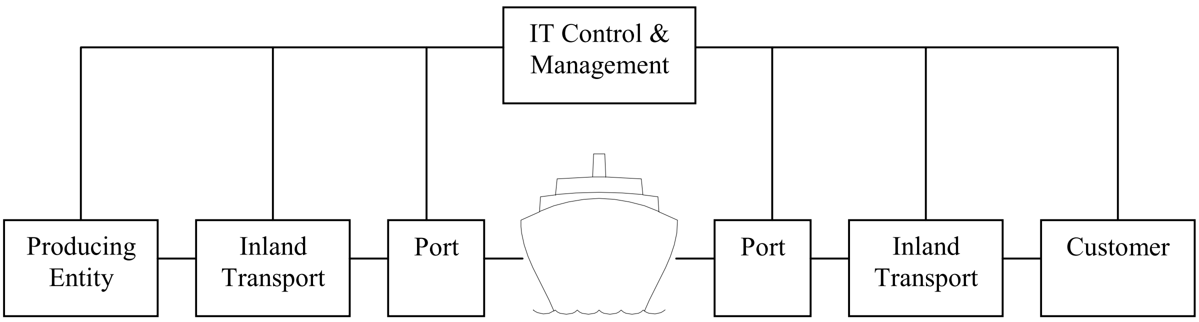

Figure 12: The intermodal transportation chain

5.5.2.3 Internal environment

Strategic capability is linked to the competitive position of an industry/organisation and its ability to sustain competitive advantage. In order to understand the strategic capability it is necessary to consider various areas in the industry. The capability of the waterborne transportation industry is fundamentally determined by the separate activities it undertakes in handling, marketing, delivering, and supporting its services. It is the understanding of these various activities and their inter-relationships, which is crucial when assessing strategic capability as outlined in the following.

There are a number of aspects that must be reviewed in order to provide a background for determining strength and weaknesses. These are:

- Past and future markets.
- Transportation chain.
- Transport time.
- Running costs.
- Transportation costs.
- Socio-economic cost.

An industry's strengths and weaknesses may be diagnosed by adopting a "Value Chain" approach, which systematically examines the series of activities an industry performs in order to provide its customers with a product. The "Value Chain" desegregates an industry into its strategically important domains to understand the behaviour of the industry's cost and potential sources of differentiation. This is in order to be able to identify areas where the industry can gain a competitive advantage by performing these strategically important activities at a lower cost or better than its competitors. The activities can be grouped into *primary* and *support* activities, which are the basis for identifying strengths and weaknesses, i.e. an industry's strategic capability. By later examining the opportunities or threats an industry might experience its strategic position can be determined.

The first step is to identify primary value activities, which involve the physical creation, marketing and delivery of the shipping industry's product or service. The second step is to identify the support activities, which provide the infrastructure, or inputs, that allow these to take place on an ongoing basis. These activities and their sub-areas are represented in a matrix format, as illustrated in Figure 13, and used to identify strengths and weaknesses.

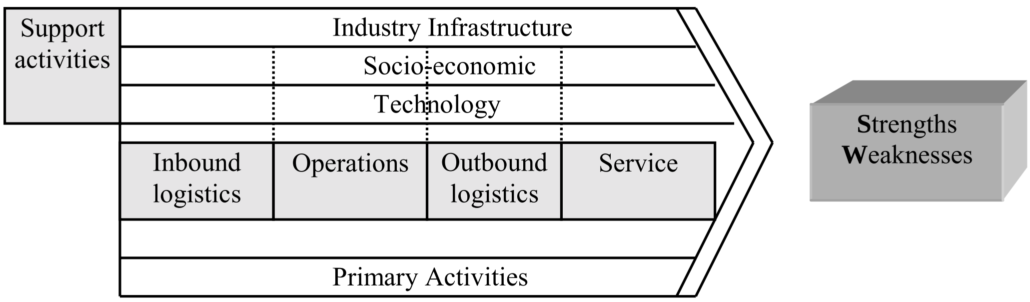

Figure 13: Value-chain matrix

The review of internal environment and its strategic capability result in the determination of strengths and weaknesses, which are summarised in Table 2.

Table 2: Waterborne transportation strengths and weaknesses

Strengths	Weaknesses
No sailing restrictions	Flexibility
Low infrastructure investments	Frequency
Emissions to atmosphere	Slow and out-of-date solutions
Habitat pollution	Turnaround time
Remove dangerous cargo from road	Reliability
Cost per ton/kilometre	Complexity of waterborne transport
Not as affected by a carbon tax	Internal industry disagreements
Able to handle high weight and volume	Port fees
Higher safety level	Customer service and use of IT
Barge/ship interface without intermediate depot	Infrastructure needs improvements
Waterborne-only transport	Bottlenecks at interfaces

5.5.2.4 External environment

The waterborne transportation industry is influenced by a host of external factors that direct company decisions and strategies, which are outlined in the following. The relationships between these factors form the basis of the opportunities and threats that the industry faces in its competitive environment.

The remote environment comprises five factors that originate beyond, and usually irrespective of, any single industry's operating situation. The environment presents industries with opportunities and threats. The five factors are:

- Political Aspects.
- Economy.
- Social.
- Technological.
- Environmental.

The operating environment comprises four factors that usually are the ones felt as the most important, or manageable, in the daily running of the business. These are:

- Competitors.
- Suppliers.
- Customers.
- Labour Market.

The nature and degree of competition in an industry hinge on five forces as outlined below. To establish a strategic agenda for dealing with these contending currents and to grow despite them, an industry must understand how they work in its environment and how it affects it in a particular situation. These five forces are:

- Threat of entry.
- Power of suppliers.
- Power of buyers.
- Threat of substitutes.
- Competitive rivalry.

The external environment provides the necessary information in order to identify opportunities and threats within waterborne transportation as illustrated in Table 3. In general, an identified weakness in shipping may be developed into a strength by focusing on the reasons behind the weakness. In the case of waterborne transportation, it must offer an equivalent logistic service to that of road or rail transportation. Identified strengths must be maintained and further developed in order for them not to turn into a weakness. The fact that shipping needs waterways is a limitation, and shipping must establish door-to-door services in co-operation with rail or road unless the receiver is located close to waterways. The customer wants one part to take care of the freight and shipping companies should offer a total logistics service comprising ship, rail, and road.

Table 3: Waterborne transportation opportunities and threats

Opportunities	Threats
Removal of subsidies and cabotage Economies of scale Increased transportation of goods from eastern Europe Opening and liberalising inland waterways OECD & GATT agreements New designs and cargo handling systems Improvement of logistics and interfaces Modal shift from road to sea Industry agreements Offering of full third-party logistics services Multi-modal logistics	Customers perception of shipping Investment made in infrastructure on land Frequency and reliability of trucks Low profit margin in cargo freight Underbidding by competitors Wash problems in coastal and river zones Lack of qualified seafarers

5.5.2.5 Strategic analysis

SWOT analysis can be used in many ways to aid strategic analysis. Systematic SWOT analysis should as a key point, range across all the aspects of an industry's situation providing a dynamic and useful logical framework for strategic analysis. The SWOT analysis diagram is illustrated in Figure 14.

The waterborne transportation industry can best be represented in Cell 1 for various reasons. The previous analysis has identified numerous environmental opportunities. One of the main opportunities relates to the political scene, where there is a substantial positive attitude for a modal shift of cargo from road to sea at the same time as the amount (tonnage and volume) of cargo is increasing. Furthermore, the EU is intending to remove subsidies and thereby make each mode of transport pay for the usage of the infrastructure. Another major opportunity is horizontal integration so as to provide a total transportation system. The infrastructure of inland waterways presents another major environmental opportunity in that they are being opened and liberalised. However, major investments are needed.

The paper presents some internal weaknesses with respect to new technology and investments that must be solved. If an agreement can be reached between parties in the intermodal chain regarding investments in infrastructure and its technology it will create significant strengths. Some of the weaknesses are customer perceptions that have occurred due to the waterborne transportation industry being product rather than customer orientated. By providing a better and streamlined service this can be addressed and turn a weakness into a strength.

This should substantiate enough strengths to warrant an aggressive strategy. Situations change with the passage of time and an updated analysis should be made frequently. SWOT analysis is neither cumbersome nor time-consuming and is effective because of its simplicity. Players within their industry should at any time know their SWOT as not knowing your enemy can and will lead to defeat. If the critical internal weaknesses already mentioned are not overcome it might warrant a change to another strategy. The new strategy will depend on whether the waterborne transportation industry has managed to capitalise on the opportunities or let them pass. The latter will put the industry in a dangerous position with major environmental threats.

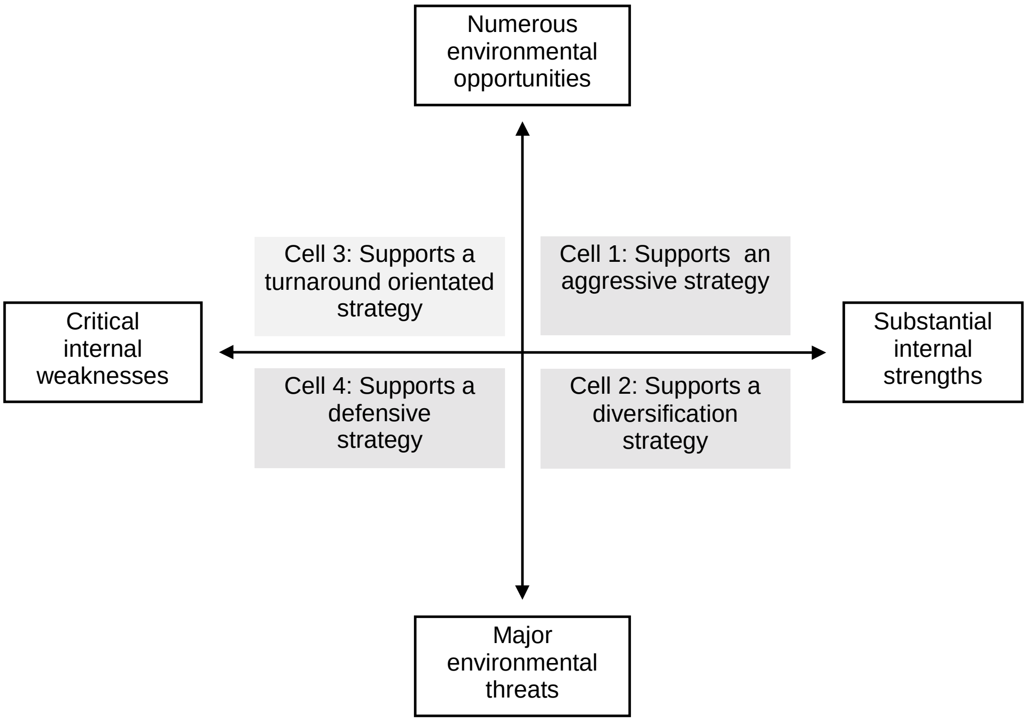

Figure 14: SWOT analysis diagram

The aim with a grand strategy selection matrix is to seek strategic alternatives that offer a stronger fit with the industry's overall situation. The matrix offers a total of 12 grand strategies as illustrated in Figure 15.

An industry in quadrant I is often viewed as over-committed with limited growth opportunities or high risk. The external approaches to overcome weaknesses usually result in the most costly grand strategy. Acquiring a second industry player demands large investments of time and large financial resources. One should be careful not to exchange one weakness with another.

More conservative ways of overcoming weaknesses are found in quadrant II. It is often a choice of redirecting industry resources from one internal activity to another. This way, the industry maintains its commitment to its basic mission, rewards success, and enables further development of proven competitive advantages. If the weakness has arisen from inefficiencies, this grand strategy can actually serve as a turnaround strategy. The industry is able to gain new strength from streamlining its operations and eliminate weaknesses.

A common saying states that a firm should build from strength. A large enough market share should be captured to allow economies of scale. If it is possible for the industry to make this profitable by maximising internal strength then the four grand strategies in quadrant III should be the choice. If an industry is to aggressively maximise its strengths it requires an external factor. This falls into the grand strategies of quadrant IV. The first strategy being horizontal integration which allows a quick increase in output capability. Concentric diversification is a second choice for quick expansion of capabilities.

With a strong backing from the EU and a continuous strive to find alternative and more environmentally friendly transportation methods, an aggressive grand strategy from quadrant IV seems to be the most viable option. This is based on the reasons given in the SWOT analysis where Cell 1 is seen as the best option. The strategy is mainly chosen to maximise the strengths of the industry, such as safety, ecology, economy, and political backing in order to eliminate and overcome the weaknesses. However, the strategy must be dynamic and change over time.

Horizontal integration is the grand strategy (quadrant IV) that will best cover the waterborne transportation industry if its aim is to fuel growth through becoming a TTO (Total Transportation Operator). Horizontal integration is based upon the acquisition of one or more transport industry operators. It is a highly likely scenario and aims to eliminate competitors and provide the acquiring operator with access to new markets. Another alternative is to form close alliances, which would minimise or share the need for high capital expenditure. Furthermore, alliances should help to resolve internal industry disagreements and create a common goal.

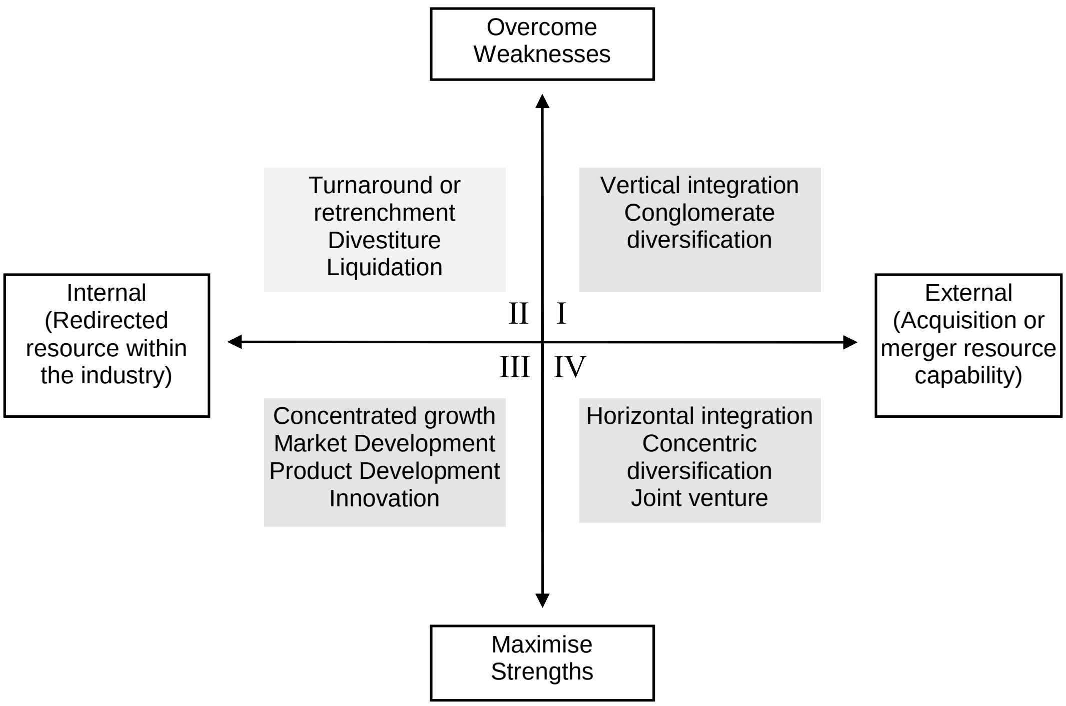

Figure 15: Grand strategy selection matrix

An industry will always seek to improve its profitability, growth, and survival. These points should thus be included when developing long-term objectives and grand strategies. To achieve long-term prosperity, one should try to establish long-term objectives in the following areas.

- Profitability through strategic alliances and quality products.
- Productivity through efficiency, reliability, safety, and lower crew demands.
- Competitive Position through improved services, flexibility and optimised interfaces.
- Technological leadership through application of new technology, vessel design, and environmental friendly solutions.

Long-term objectives must be set and key success factors determined in order to move the waterborne transportation industry forward. In this respect, it is pointed towards the development of decision support tools in order to minimise the risks related to investments in waterborne transportation. This is the aim of the FAROS/FASTWORKS project.

5.5.3 Route scenarios

5.5.3.1 Route knowledge base

The INSPIRE project has gathered and generated vast amounts of information and data. For this to be useful, it is necessary to develop a structured knowledge base for the studied route that facilitates retrieval of relevant information to assist ship designers, service providers, owners and operators in a unified way. The knowledge base is the cornerstone of the formalised methodology and is under development at LMG Marin.

The key principles are that information must be shared between all players in the transport chain and information must be understood in the same manner by all. By studying all elements of the intermodal transport chain, a comprehensive knowledge base can be constructed. The knowledge base provides the core information needed to select a particular route and to specify the logistic requirements and design criteria that a new ship design must adhere to. The main entities to be studied are ships, ports, hinterland, cargo and hydrographics. In addition, the information system supporting the transport chain must be analysed and defined.

The ship study is initiated by examining existing ships trading to and from the studied regions, in order to identify current shipping practices. Examples of important information are:

- Types of ships.
- Ship size and speed.
- Frequency of calls.
- Sea condition data.

The most important types of information are any existing restrictions on the studied corridor with regard to draught, speed, safety regulations, etc. as they may impose restrictions to be incorporated in the logistical chain. Additionally, it is aimed to identify ship criteria that are missing or of poor quality. The ship study divides the design criteria into four main categories; technical design, safety features, operational issues, and environmental aspects in order to identify their implication on design. The optimum ship type is selected by evaluating different ship types able to accommodate the cargo and speed in question.

The port study aims at identifying the potential ports along the route in question. For each port the knowledge base must cover all relevant details that may prove useful both in selecting the relevant ports, and in discovering restrictions and shortcomings that must be dealt with in developing a new transport corridor. Examples of relevant data are:

- Port costs levied against both ships and cargo.
- Time usage in port.
- Seaward approach.
- Intermodality and interfaces.
- Cargo handling equipment.
- Cargo storage facilities.
- Network of agents, freight forwarders etc. and their role in the port.
- Hinterland transportation network.

An efficient interface between ship and port is a crucial factor in a shipping system to minimise turnaround time. Special emphasis is paid on this aspect in order to determine the criteria that are important in the cargo-handling phase. Aspects that are considered include port and ship cargo areas and lanes, ramps, trucks, flood-doors, lashing systems, and costs.

The distribution of cargo to/from the port from the larger hinterland is an important issue in the intermodal transportation system. The alternative hinterland transport means are:

- Trucking.
- Inland/Fjord/Coastal cargo ships/barges.
- Cargo trains.

Adopting a supply chain management approach to intermodal transport the best solutions can be implemented where criteria can be set as required, e.g. time and costs.

The cargo study is initiated by identifying and structuring market data in the studied regions in order to estimate quantities and the nature of cargo movements, which eventually are used to determine frequency of service and payload capacity. The existing logistics in the studied regions are evaluated in order to identify the required logistic criteria for a waterborne transport system that can satisfy cargo owners. Aspects that will be considered in such a study are:

- Identification of commodities moving, composition and size of market, importers and exporters of the principle cargoes, average parcel sizes, and requirements and provision of cargo transportation.
- Present traffic volumes and recent growth patterns, together with outline projections for future volumes. Seasonal flows and ramifications for service frequency and costs.
- Imbalance in traffic in either direction on a route, together with other factors that distort the commercial operations of shipping services, such as demand for passenger capacity in peak summer months resulting in low freight space availability.
- Identification of the commercial and operational requirements of shippers with significant transport requirements on the trading corridors being examined.

A well-known problem encountered during this process is that the statistical data on land and sea transport in Europe are insufficient and only partly covers the information required. There are several national data sources available concerning trade and cargo movements, but they all have substantially different levels of quality, validity, and reliability. Another problem is the cargo identity as several different definitions are used to identify commodity groups.

Additionally, many companies do not want to share information on cargo volumes, at least not on a very detailed level. The result will normally be a database with fairly aggregated data. Planning of new systems are feasible as long as the volumes can be identified according to the following shipping modes:

- Containerised cargo, ordinary containers.
- Containerised cargo, chilled or frozen.
- Palletised cargo.
- Break bulk, general cargo.
- Dry bulk.
- Liquid bulk.

The objective is to provide route planning for the corridor in question by performing hydrographic analysis and assessing weather and sea effects on scheduling, i.e. reliability. The corridors should be subjects for detailed hydrographic analysis in order to establish the required ship parameters.

The project aims at determining application areas for standard IT tools in shortsea shipping operations and implement these in the shipping system. The work is initiated by screening on-going work and projects in this field. The identified shipping aspects studied are:

- **Navigation**. Aspects targeted are the use of electronic charts, ship control centres, and improved manoeuvring.
- **Ship arrival and departure**. There are several administrative and operational tasks related to the berthing of a ship and a considerable flow of data, which are not automated to a satisfactory degree. Information could be sent automatically from the ship by using computer software and standard telecommunication systems. The main requirement to achieve this is that the users of the information have compatible software in order to share the information.
- **Cargo loading and unloading**. Applying modern cargo control and management systems could reduce time-consuming operations, such as cargo registering, in the unloading/loading sequence in order to increase efficiency, reduce errors, and record the information assigned to each cargo unit. Several cargo loading/unloading systems are studied in the project.
- **Cargo tracing**. Cargo tracing is an IT service to shipping customers that improves the estimated arrival time of the cargo. Standard systems can be applied for this task and the project's objective is to define the best solution for cargo tracing and implement it in the shipping system.

The ideal is of course to implement a system that is used by all parties in the logistical chain from cargo owner, via all transport operators to the final customer. The main advantage of such a system is that data need only be registered once to be accessible for all. This will give dramatically improved intermodal efficiency. Such systems do exist and the project will evaluate how such a system could be practically implemented on the route in question.

5.5.3.2 Route scenarios

The design of new cargo vessels today is a challenging task. Logistic strategies seem to be changing at a higher rate than ever before. New customer needs and new information technologies are emerging rapidly, and the competition between transport providers is intensifying. In addition to this uncertainty, new vessels should be designed in order to operate typically for more than twenty years. One could easily argue that there is a strong need to address the future and the uncertainties associated with it, in order to obtain robust vessel designs. Scenarios may be used to handle such uncertainties and they may give input, together with information from the knowledge base, to the design and evaluation of new vessels.

Route scenarios are related to the strategies of cargo owners, local environmental issues, technological changes etc. and are needed to identify route specific uncertainties. The route scenarios cannot be developed until the route knowledge base is complete.

The macro scenarios, as dealt with by the strategic analysis outlined above, forms the basis for how the project team is viewing the strategic choices and long-term objectives. This process also identifies the key decision factors in form of SWOT, which must be targeted in the scenario work. The scenario process is illustrated in Figure 16.

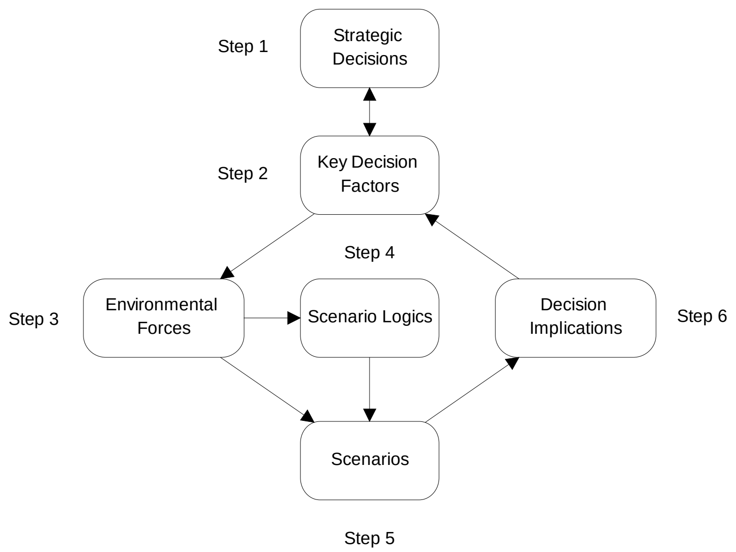

Figure 16: The scenario process

5.5.4 Logistic considerations

There have been considerable efforts in recent years to develop intermodal transportation systems using waterborne transportation as a main entity in such systems. The incentive behind this effort is the political ambition of moving cargo from road to sea.

In order to maintain or increase the competitiveness of the European economy as a whole it is essential to improve the efficiency of the Trans-European Transportation Networks (TEN). This becomes even more important when forecasts for transportation in Europe indicate a significant increase in transportation volumes over the next decades, which is way above what the current transport infrastructure can possibly accommodate without huge congestion problems.

5.5.4.1 Trends in logistics

As international competition is getting more and more pronounced, the role of logistics is playing an increasingly important role in the total management of a company. In the mid 80s, the consultant company A.T. Kearney did a larger study on the development of logistics in various firms and concluded that logistics rapidly had developed from being a question of reducing transportation costs for outbound goods to become a strategic issue in the more advanced firms. In Table 4 companies have been classified according to their logistical sophistication, with stage 3 companies having integrated their logistics into the overall strategies of the firms.

Table 4: Trends in logistics

Stage 1 Companies: **Controlling outbound transport and warehousing**
• Outbound transportation
• Intra-company transportation
• Finished goods warehousing
• Logistics systems planning
• Logistics control
• Logistics management
Stage 2 Companies: **Logistics as an integrated part of the physical distribution process**
• Customer service
• Order processing
• Finished goods inventory management
• Finished goods plant warehousing
• Inbound transportation
Stage 3 Companies: **Logistics as a strategic function**
• Sales forecasting
• Production planning
• Sourcing
• Raw material/work-in-process inventory
• Logistics engineering
• International logistics

In Table 5 the likely development of the distribution of firms in the various stages is indicated. The estimates for 1995 are our own and should be treated with more than just scepticism. The main point is however to indicate that future plans of developing new transportation systems must fit in with the requirements of an increasing number of logistically advanced firms. Around 70% of the customers of tomorrow's transportation systems will require that such systems fit into their logistical strategies. Then it is no longer just a question of low transportation costs.

Table 5: Development of logistical sophistication in %

Type of firm	1981	1985	1995
Stage 1 firms	54	42	30
Stage 2 firms	30	38	45
Stage 3 firms	16	20	25

5.5.4.2 Customers preferences in liner shipping

Taking a closer look at the characteristics of a liner shipping service, the service parameters are indicated in Figure 17. Together these parameters determine the logistical characteristics of the service, and it is instructive to make a distinction between logistical *efficiency* on the one hand (meaning "doing things right", at lowest possible costs) and logistical *effectiveness* on the other (meaning "doing the right things", according to company strategies). To choose a suitable combination of service parameters, one should know more about the customers' priorities.

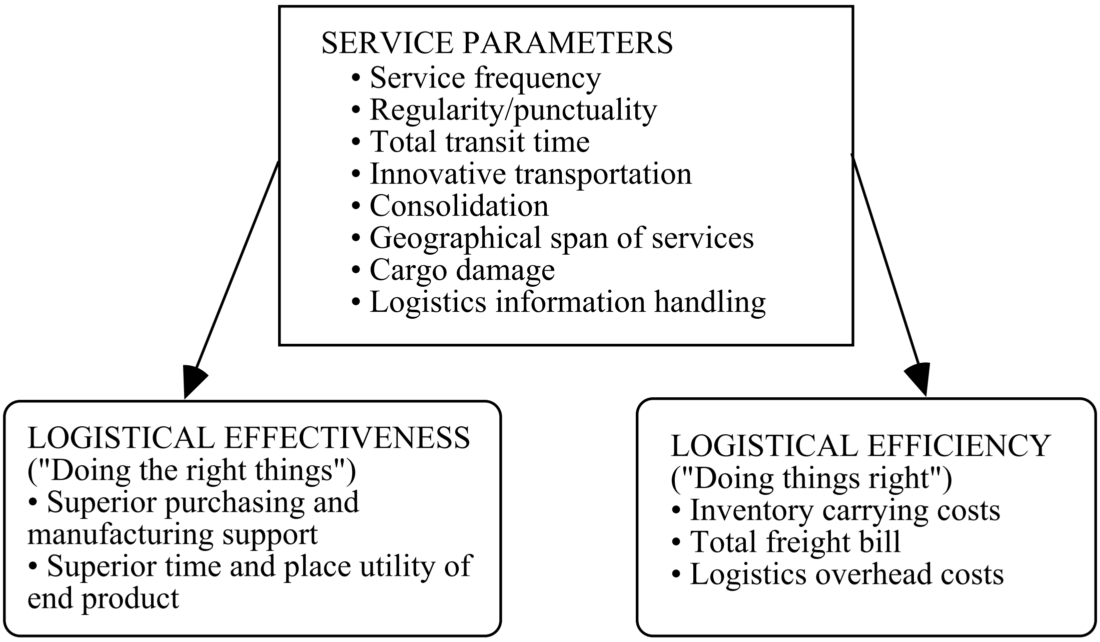

Figure 17: Transportation and logistics

Detailed interviews with some larger liner/Ro-Ro operators in Norway provide some hints at the direction of the answer. It is difficult to compare answers from different people in different organisations and not to dwell on the technicalities, the method employed was simplistically the "Analytic Hierarchy Process" (AHP). This method allows consistent ranking of qualitative issues and in this particular AHP study, each person assigned the numbers 1 to 9 to each alternative. If all persons agreed that a particular alternative should be ranked as the most important, the number 5 would be the result. The higher the number, the more disagreement among those interviewed. The results are briefly summarised in Tables 6 and 7.

First, it is interesting to see how liner-shipping customers value the two different aspects of logistics - the effectiveness vs. the efficiency. All the interviewed agreed that the strategic function of the logistics (in offering the right product support and to have the product correctly positioned in time and place) was more important than the direct cost side of logistics. All sub-elements were, however, all ranked as very important, with much emphasis on purchasing and manufacturing support and the total freight bill. For each of these five logistic factors as given by Table 6, the main parameters of a liner service were checked. The corresponding results for four of those parameters (frequency, regularity, transit-time and cargo damage) are summarised in Table 7. The generally higher numbers in table 7 indicate that the various people have different opinions as to the ranking of the various parameters. It is clear, however, that service frequency and service regularity are very important. If a fast freight route cannot provide a sufficiently high frequency of service, it will be very difficult to compete with road transportation, where the flexibility is very high.

Table 6: The importance of logistic factors

Factor	**Ranking***	**Factor**	**Ranking***
Logistic effectiveness	5	Logistic efficiency	9
Logistical effectiveness:		**Logistical efficiency:**	
Purchasing and manufacturing support	7	Total freight bill	6
Time and place utility	8	Inventory carrying cost	7
		Logistics overhead costs	14

* Minimum number => higher ranking (5=absolute minimum)

Table 7: The contribution of service parameters to logistical goal fulfilment

Logistic factor	**Liner service parameters**			
	Service frequency	Regularity	Total transit time	Cargo damage
Total freight bill	19	10	17	16
Inventory carrying cost	10	14	13	18
Logistics overhead costs	24	17	23	12
Purchasing and manufacturing support	11	12	14	18
Time and place utility	18	9	11	13
Average	16	12	16	15

* Minimum number => higher ranking (5=absolute minimum)

5.5.4.3 Customer service

In the future customer service will become ever more important and the use of ICT solutions will be fundamental in order to offer optimal service to customers. A cargo owner is only interested in getting the cargo from A to B and how this happen is unimportant. Total logistics will become standard where one organisation is responsible for all aspects of the transportation. The waterborne transportation industry must understand and implement this philosophy in order to gain market shares from road transport and offer state-of-the-art solutions.

The lack of communication between cargo owners and shipping operators is believed to have contributed to the high growth of the truck industry, which has strongly focused on customer needs and total logistics. The traditional thinking of the shipping industry has been from port to port and thus neglected that shipping is part of a larger transportation chain, which again is part of a larger business.

It is claimed that logistics is the last frontier in industrial development after having achieved large time reduction in the manufacturing process. The time has come to reduce the transport time at sea by increasing the speed of the cargo flow through the whole transportation chain and thus reducing the unit costs by higher asset utilisation and placing the fuel consumption costs in the back seat. These arguments are justified with the development of new ship designs and logistics thinking, which increase the reliability of the service and reduce the ‘what if’ calculations.

5.5.4.4 Reliability of services

The reliability of a ship service is the capability to meet agreed times of arrival and departure. This capability is directly related to the ship’s ability to sustain its speed in a seaway and to sustain the loading and unloading procedures in port.

The reliability of the ship on the route must be analysed in the design process and it must meet certain requirements set by owner/operator. The sustained speed at sea is calculated by utilising well known techniques, such as strip theory. The analysis of the loading and unloading procedures in port is today readily performed using computer simulation tools.

5.5.4.5 The importance of frequency

The road industry can offer the customer any requested frequency on arrival and departure times. This is the benchmark for the waterborne transport industry. In this respect, there is no question that shortsea shipping services must be frequent and reliable, which is the situation on most successful routes, e.g. in the Channel.

The task at hand when establishing a new route is to correctly weight the importance of frequency. The drawback in such a scenario is that it may require high investments, i.e. number of ships or faster ships, in order to satisfy the frequency demands. On the other hand, the market will be hard to attract if the frequency offered does not satisfy cargo owners’ production, or shipment, pattern.

On this background, it is clearly a need to perform in-depth market analysis of customer requirements and link this with product development in order to develop solutions that are fulfils market demands. The latter is the basic philosophy of the INSPIRE methodology.

5.5.4.6 Logistic criteria

There are two fundamental logistics criteria a transportation chain must accommodate in order to achieve a paradigm shift of cargo from road to sea no matter the speed of the ship. These criteria are *reliability and frequency*, which are dictated by customer needs and often neglected in waterborne cargo transportation. It is paramount that cargo departs and arrives on regular schedules and that the frequency of this service is high enough to attract cargo away from roads. *Flexibility* of the service is a function of reliability, frequency and ship concept where the aim for shipping must be to at least get closer to the flexibility of roads.
Some parts of the world have harsh sea conditions that may jeopardise the reliability of ship services in the wintertime. Reliability is fundamental for fast freight transportation and *seakeeping* analysis on the route in question will be fundamental when deciding on the hull form. On short routes, or on routes with multiple port calls, *manoeuvring* in and out of ports become critical with regard to time. There is a trend for freight ships on a scheduled route to have bow thrusters and even azimuths to achieve high manoeuvring capabilities. This ensures a short turnaround time and maximises operations, which is a key element in fast transport systems.

The route *range* often decides the best-suited hull form. The range influences also the speed of the ship to a great extent in relation with the other components discussed in this section. It seems that fast ships are more competitive as the range increases and the effect of the increased speed becomes clearer. However, this assumption can only be justified with an analysis of the total logistics and should not indicate that fast cargo ships cannot operate on shorter routes.

A cargo ship is only a part of a larger transportation chain and a ship must be designed around the cargo handling system in order to optimise the *port-ship interface*. There are various cargo-handling solutions that must be evaluated taking into account the market and cargo carrying units. Fast cargo handling is fundamental to justify the higher speed at sea and it is believed that some form of the RoRo concept is the preferable choice in shortsea shipping. *Navigation and docking* of fast ships may follow a predetermined schedule and path in order to avoid hazards and to keep a reliable schedule. Checkpoints along the route can be provided to the shipping management ashore in order to provide customers with reliable *estimated arrival times* for cargo.

In a transportation system ships must be suited to the industry standard for *cargo carrying units* and not the other way around. There exists numerous carriers today and in order to establish an efficient transportation system co-operation between cargo owner and shipping operator is essential to design optimal ships for the cargo in question.

Information and communication technologies are entering the society in full force and without taking advantage of the opportunities on offer by ICT it is doubtful that there will be competitive waterborne transport systems. By applying ICT customers are given the best service allowing the customer to plan according to true and real-time information on arrival and departure times for cargo. Documentation and payments will be made more efficient reducing red tape drastically.

Ship operators must integrate the philosophy of *total logistics* in order to achieve market shares in the transport corridors that will appear in Europe in the years to come and the industry must put customers in focus and satisfy their needs.

5.5.5 Design criteria

The payload a ship offers dictates the Required Freight Rate (RFR) for a successful operation. The *payload to displacement (P/D) ratio* is often referred to as the *transport effectiveness* of a ship, which is a function of the relationships between displacement, speed, range, payload, power, and fuel efficiency. Every ship has a specific transport factor and a high value generally determines a good design. Analysis using the transport factor provides a means for making comparative evaluations between different types of vehicles and provides insight to the design drivers for shortsea vessels.

5.5.5.1 Engineering

There are numerous *hull forms* applicable for ships. The various hull forms provide static, dynamic, or powered lift to carry its displacement. There is no universal best solution, but locally optimal designs suited for specific routes and cargoes. This is justified by the factors deciding upon the choice of hull forms, which vary according to weather conditions, range, price of fuel, cargo carrier, etc.

The ship *production* process is very well taken care of at European yards for any type of ships given enough time for prototyping and development of sub-processes. However, the construction prices on innovative concepts tend to be higher per ton steel, which may render projects uneconomical. Taking into account the economics there may be some constraints and in general a monohull is the cheapest and most viable concept to manufacture. It should be kept in mind that there have been yards that have run into financial difficulties after doing pioneering work on high-performance vehicles having underestimated working hours and material costs. High-speed vessels have in general higher *maintenance* costs than conventional vessels because of the harsher treatment by the environment. This issue must be treated together with production aspects and robust designs minimising maintenance should be aimed for in order to maintain service reliability.

The *structural arrangement* is important for the safety of ships and classification societies have allocated resources to this problem, which have lead to a number of load prediction programs being developed. The problem in hand is to minimise the weight of the structure whilst not jeopardising structural safety, which has spurred the use of alternative *materials* to steel. This initiative is based on the fuel savings achieved by carrying less weight, or alternatively, more payload.

Speed at sea must be accompanied by speed in *docking and cargo-handling systems*. There is ongoing work in the EU to automate the docking procedure by using sensors and computers, which will reduce human errors and ensure reliable docking times. There is also work underway to develop better and more efficient cargo handling systems optimising the ship-port interface, such as IPSI, having simultaneous loading and using ICT to minimise bureaucracy. It is believed that these aspects will be standard within a few years accommodating shipping.

In aftermath of recent accidents in Europe considerable efforts have been spent to develop more efficient *marine escape systems*. The state-of-the-art technology in this area is currently slides guiding crew and passengers into the life rafts without entering the water. Marine escape systems are however last resort and a damage or fire should be dealt with prior to escape becoming necessary by establishing the ship as a safe haven. The work in the SAFER EURORO project targets all aspects of safety, and although focusing on passenger ships, the findings will also be relevant to the other parts of the industry, which should aim for high safety targets in order to establish reliable services.

Most vessels are sensitive to motions in seaways and *motion control systems* are standard on ships today. Depending on the hull form a motion control system should be implemented in order to maintain speed in waves and to enable a stable operation of the ship minimising the seaway motions.

5.5.5.2 Ecology

The transportation industry as a whole is a major contributor to negative environmental effects and common to all modes of transport is the dependence on energy that is supplied by burning fossil fuels. The usual way to measure and compare energy consumption is to find the energy used per transported ton and km. The amount of CO_2 that is released to the atmosphere is directly linked to the amount of energy consumed and low energy consumption is therefore a key to environment-friendly operation. The ecological concerns in shortsea shipping are mainly related to *emissions and wash*, whilst road transportation causes wear and tear of roads requiring maintenance and air and noise pollution in populated areas.

However, it is clear that fast ships pollute more than traditional ships and there have been suggestions that fast shipping is less environmental friendly than road transport. In this respect, it is necessary that the industry address this problem in order to enhance its social profile. Means to achieve an improved environmental profile may be to investigate the use of low-pollution fuel, lightweight materials, and the use of catalysts.

The wash from ships represents a problem in coastal zones requiring research in order to provide solutions. Wash causes a number of problems, such as: Danger to passing vessels and people at the seaside; Erosion of shorelines, riverbanks, and structures; Swamping of low bridges; and damage to marine life. The problem in hand is to design hull forms that generates less waves, which also reduces the fuel consumption. There is research underway in this field in the FLOWMART project targeting this problem for high-speed vessels.

5.5.5.3 Safety

Safety is a broad concept and both definition and understanding of it vary widely, but a proven definition of safety is; ‘safety is a perceived concept, which determines to what extent the management, engineering, and operation of a system is free from danger to life, property, and the environment’. There is a trend towards two concepts in assessing safety, namely the safety case and formal safety assessment.

Within a few years the SOLAS rules will be harmonised into a probabilistic rule set for both passenger and cargo ships. The number of passengers and crew onboard will decide the safety level and cargo ships will thus experience less stringent rules for intact and damaged stability. The SOLAS rules will then see to that operators conform to the same design criteria and haphazard approaches to safety will be avoided. There have been numerous accidents with conventional cargo ships, but they have not attracted the same media attention as e.g. the Estonia accident. Safety must be a benchmark for the shortsea shipping industry delivering reliable and safe service to its customers.

On this background, safe maritime appliances are of paramount importance because the costs associated with the loss of human life and environmental damage are not acceptable for the society. However, safety in design is still treated haphazardly by designers in the way that safety conformance is rule-based and not an integrated part of the design process. In this respect, safety is kept aside the creative design phase and measures are taken in the aftermath in order to comply with regulations. This aspect is targeted through the SAFER EURORO project.

6 CONCLUSIONS

6.1 POLICY RECOMMANDATION

Policy recommendations are given for general aspects pertinent to EU shortsea shipping and aspects that have arisen during the two-year INSPIRE project. Furthermore, specific policy recommendations are given for the four corridors studied.

The policy recommendations seek two audiences. Firstly, the recommendations aim to guide industry players on aspects the INSPIRE consortium considers relevant after the two-year research period. Secondly, the recommendations aim to provide policy makers insight into shortsea shipping issues, which may become useful in their efforts to advance the industry.

6.1.1 General

6.1.1.1 ICT in transport research

The gap between the technologist and the non-technologist is currently slowing the development and use of ICT in transportation on a European scale.

The use of ICT systems in research is continually expanding. This results in a conceptual gap between developers and users of ICT solutions, which must be properly addressed in the early phases of a project in order to minimise any potential negative effects.

Those involved in preparing research proposals need to be aware that this issue can be significant and requires planning and careful monitoring throughout the life of a project.

6.1.1.2 The data issue in EU shortsea shipping

Significant time and expense is allocated to collecting data within research projects. Much of this data is relevant not only to the project in which it is being collected but most probably to a number of other projects within the same field. In the current environment data is often collected very much in a vacuum - data collected for one project is seldom re-used in other projects and indeed is often not even made available to groups outside the immediate project consortium. Furthermore the same data is often "re-collected" by two separate projects. This has a negative side effect of taxing the good will of the organisations that take time to supply data to researchers.

The EU CORDIS Internet web site has since INSPIRE commenced, initiated the publication of EU transport data. This effort has a lot of merit although the web site data could not be made use of within INSPIRE.

INSPIRE has produced very much data for the four corridors and the data is valuable in itself. However, it is recommended that such data be transferred to the EU CORDIS web site in a specified format, which should be adopted by all transport research projects. It is hoped that the CORDIS site with time will develop into a practical tool, which can be used for such work as e.g. performed in INSPIRE.

Sustaining the increase of freight transport integration throughout Europe is vital to the continued success of the European Union as an economic entity. Central to integration is the effective manipulation of information for analysis and planning - nowadays by means of ICT systems. Historically, transport has been an uneasy partnership of necessary collaboration coupled to a desire to protect "in-house" knowledge as much as possible. While this is common to most commercial business the transport sector has been particularly slow to see the potential advantages (both to themselves commercially and to Europe as a whole) of sharing information with others in the commercial and research sectors. A further issue lies within the nature and format of data. While substantive amounts of data is collected annually by individual organisations and Government / European agencies, it is often very difficult to reconcile this information due to differing formats, criteria, baselines etc.

INSPIRE advocates that the issue of the availability of substantive, consistent data relating to commercial freight transport needs to be addressed. The authors are of the opinion that the European Union is best positioned to see this undertaken.

The existence of the Eurostat department for collecting and dissemination of statistics is known. One unit of this department in concerned with transport and Council Directive 95/64/EC imposes all member states to submit quarterly and annual figures on a harmonised basis from 1997 and onwards. This data was made available in 1999 on http://europa.eu.int/en/comm/dg07/tif/index.htm and is a very helpful guide to getting an overview of cargo movements within and between the EU member states.

It is recommended that the representatives from the Member States, interacting with the Eurostat department, should be familiar with the issues concerning intermodal transport and ideally have a research and/or commercial background. This will highly enhance the quality of transport data and make this issue a strength instead of a weakness in shortsea shipping. The experience within INSPIRE in relation to data collection was such that it has irrevocably altered the approach that will be taken in future projects. The authors are aware of projects, which are addressing methodologies for collecting information in intermodal freight transport, but none addressing the actual collection and central management of transport data in a scientific manner. The latter should be targeted in future research.

6.1.1.3 Shipping related issues

There is currently a need for innovation in shortsea shipping where aspects ranging from hydrodynamic performance, via safety and speed, to functionality and logistic performance must be vertically integrated. This is the focus of the FAROS project.

Ship design research has traditionally focused on optimising a separate issue, or function, and little attention has been given to the fact that a ship is only a part of a transportation chain, which again is a part of a larger business or economy.

Innovation in ship design must stem from customer requirements and it is believed that the theory of supply chain management will dictate such requirements in the foreseeable future. This is background for the RODEO project. In this respect, a ship must fulfil these requirements or it will lose market shares to the other modes of transport.

One of the interesting aspects of supply chain management is that the question of ship speed will be a result of the transport demands and not be governed by the ship operators' fear of investments and higher fuel consumption when establishing faster services. The fuel cost of a ship is only one part of the total supply chain costs, which also comprise cost of warehousing, trucking, depreciation, delays, packaging, handling, customs, etc.

Ships can transport large quantities of cargo over long distances with comparatively low fuel consumption and emissions to the atmosphere. While it may be tempting to increase the speed of ships to make them more competitive with other transport modes in terms of transport time, this has its price. It is therefore recommended that the lowest acceptable average service speed should be encouraged. An additional speed potential is desirable, in order to satisfy demands for regularity for maintaining a fixed schedule also under adverse conditions of weather, tide, traffic, loading etc.

The utilisation of LNG/CNG as shipboard fuel is today achieved for prototype ships. There are plans in Norway to develop a full-blown distribution system for LNG along the west coast, which will supply the domestic ferries, the oilfield service fleet, general coastal cargo ships, etc. The extra development and production costs for the prototype designs have been approximately 30%, which historically will decrease to 0-5% for the next generation LNG fuelled ships. The LNG fuel cost is claimed to be competitive with diesel fuel. The savings in emissions are significant. The NO_X is reduced by 80-90 % and CO_2 by 20-30 % compared to marine diesel emissions. The increased market demands for speed result in higher energy utilisation and more emissions to the air. This issue will be greatly reduced by converting to e.g. LNG fuel. There is currently work underway to implement LNG on fast/high-speed ferries as this p.t. is not standard technology due to the weight sensitiveness of such vessels.

Cargo owners want to know where their cargo is at all times and when they can expect it to arrive at the agreed terminal. Suitable systems for remote registration of a ship's position exist, as demonstrated for instance in the PROSIT project. A general introduction of such system on ships in European waters would enhance the credibility of shipping in relation to other modes of transport. At the same time, the safety of crew, ships, cargo and environment would be enhanced by the fact that precise information on position is available in case assistance is required.

The introduction of "Black Boxes" on all ships, recording vital information, will have a positive effect on safety. Not only is this related to accident investigation and precautions taken on the basis of experience gained, but the fact that data are recorded can increase the risk of being caught if rules and regulations are not met. This will, under various circumstances, assist the seafarers when resisting outside pressure.

Tonnage measurement rules were changed in 1969 to get a rational system for comparison of ships and to avoid extreme designs with no other purpose than beating the paragraphs. In spite of the good intentions and generally acceptable consequences, it is a fact that certain innovative ships are being punished by the interpretation of the "new" rules. This applies amongst others to the hatchcoverless container ships introduced in European short sea shipping by the Irish Bell Line. Tonnage related dues made them less competitive and hindered further exploitation of a sound idea. It is therefore recommended that an opening is made for reconsideration of dues and charges related to shortsea shipping.

6.1.2 The Irish corridor

The Irish case study concluded by recommending the following issues to be recognised and appropriate action taken by all concerned:

- That a serious and growing problem exists with regard to Ireland's unitised cargo transits using Great Britain as a landbridge to and from Europe, and that direct reliable services can alleviate the problem. The annual flow is estimated to be in excess of 500,000 road journeys. The UK and/or Irish Government might be encouraged to commission a study to identify the flows more precisely, and to determine what incentives or disincentives are needed to achieve a shift in mode and route decisions.
- That cargo owners need to be persuaded that direct sea routes are cost effective and provide a satisfactory quality of service. This can be progressed through conferences and press coverage if government and the industry are convinced there is a message to be imparted. Those providing direct sea services, whether ro-ro i.e. Irish Ferries and P & O European Ferries (Irish Sea), or lo-lo i.e. Eucon and Eurofeeder, should be particularly receptive.
- That there is room for more liaison between competing cargo owners in sharing non-confidential information regarding shipping problems and that combined solutions can be discovered to alleviate these.
- That the image of shortsea shipping in general, and specifically the advantages of direct services for this corridor, should be promoted and enhanced at local, regional and national levels.
- That direct services utilising purpose-designed conventional and fast ro-ro vessel concepts, and open hatch lo-lo vessels have the potential to improve direct services and thereby reduce Great Britain landbridge transits.
- That open-hatch container vessels should not be penalised with higher port operational costs if they are to compete with conventional container vessels of similar TEU capacity.

Further research should target the following aspects:

- Determine the unitised cargo flow from Ireland and Northern Ireland using the UK as landbridge.
- Educate cargo owners and policy makers on the benefits of direct sea transportation and convey this message to the public in order to improve the image of shipping.
- Undertake route-specific projects, which can attract the necessary start-up support and capital in order to bring about the desired modal shift from road to sea. Such projects should be based on the data from exporters and importers in order to quantify the market, leading to cost-efficient solutions being developed.

6.1.3 The Portuguese corridor

The Portuguese case study concluded by recommending the following issues to be recognised and appropriate action taken by all concerned:

- Investments in *port* infrastructures and equipment should be made in order for the ports to become logistic platforms in order to accommodate new innovative ships with higher demands for shorter turnaround times. These investments should pertain to information and communication technologies as well as physical infrastructure developments. The ports should adopt 24 hours working hours and rationalise, harmonise and simplify the port procedures. Uniformity in port tariffs should be extended to the Portuguese islands

and liberalisation of the utilisation of the island ports should be considered and free trade zones should be established in the Azores in line with the zone in Madeira.
- Investments should be made in the *road* networks and for the hinterland port connections on the Azores. Waiting time should be reduced for hinterland entry to ports. External costs related to infrastructure and pollution should be introduced in the costs of road transport. Inland clearance depots and/or multimodal transport centres should be developed.
- There are plans for upgrading and expanding the Portuguese domestic and international *rail* networks. Shipping should harmonise its solutions with rail infrastructure and rolling stock standards. Rail accessibility to port terminals should be created having optimal interfaces.
- The Lisbon and Vale do Tejo Region should be made *intermodal* hubs for the Portuguese internal and external trade and other inland depots should be established along the country at strategic road and rail nodes. Partnerships systems between rail operators, ship operators and road hauliers should be developed using compatible ICT systems in order to promote intermodality, interoperability and interconnectivity through greater co-operation.
- Training and re-qualification of *labour* should be promoted to make personnel able to adapt to flexible systems and work in multi-functional teams. Employers' and trade unions' policies need to harmonise employee participation, investment in training, pay levels, working time and working conditions, to prevent unfair competition between modes.

Combined projects under the PACT programme should be developed, as they would support the sustainability and economic growth of the Islands. Pilot projects should be developed, which involve the study of new ship concepts, such as ro-ro/ro-pax ships. Such solutions may promote tourism and people's mobility between the islands and at the same time take market shares from air transportation.

The suggested coastal ro-ro service between Lisbon and Leixao must be further analysed and compared to road transport regarding cost, logistic, safety and environmental issues.
The issue of empty containers must be further targeted in order to develop feasible industrial solutions. Investments are needed in ports and shipping line agreements are needed in order to implement the suggested transport system.

6.1.4 The Spanish corridor

The Spanish case study concluded by recommending the following issues to be recognised and appropriate action taken by all concerned:

- The European Commission is promoting policies to reduce the effect of isolation of remote regions and there are a number of measures that may be taken in order to improve the competitive position of the Canary Islands. One measure is the creation of logistic platforms as hubs for America/Europe/Africa trade, with port infrastructures able to accommodate and handle the biggest container vessels in the shortest time and with reasonable dues and taxes. Another measure is to reduce the total door – to – door time between the Peninsula and the islands. This may be achieved through reducing the number of port calls, increasing the speed or improving liner co-operation.
- The creation of a ZEC (Zona Especial Canaria = Canary Island Special Zone) in Gran Canaria, La Palma, Lanzerote, Tenerife, etc. elaborating imported bulk raw materials from Africa or South America and exporting finished products to Europe, will reduce unemployment rate in the Island and fill the empty return space in Liner vessels.

- The inter-island transport infrastructure should be improved by expanding the harbour capacity not only in Las Palmas and Tenerife but also in smaller islands like La Palma and Lanzarote in order to reduce the effect of double insularity for the outermost islands.
- The accessibility to ports in the Canary Islands and in the Spanish Peninsula should be improved in order to reduce the bottlenecks during working hours and to lift the heavy traffic restrictions in weekends.
- The administration and service level at the port terminals should be improved by being open 24 hours 7 days a week and offering uninterrupted intermodal transportation. Port infrastructure should be improved in order to accommodate for growth in truck and container handling. The stevedoring structure should be looked upon, as there are high costs associated with stevedoring. The ship/shore intermodal efficiency should be improved.

There is scope for establishing innovative ro-ro routes from the Peninsula to the Canary Islands, as well as along the Spanish coast. Further research should pertain to the market and technical aspects of such ro-ro routes.

The further research of improving the passenger liners between Peninsula and Canary Islands with fast ro-pax vessels will offer the tourism incentive of sea travel calling at several Canaries ports. Ro-pax vessels will also enable cargo transportation. There may be a possibility to combine the ro-ro industry with the one of ro-pax.

There is scope for making the lo-lo liner service between the Peninsula and the Canary Islands more effective by re-structuring the current transport systems.

The use of Electronic Data Interchange (EDI) and Information and Communication Technologies (ICT) between the various players in the maritime community should be further improved.

6.1.5 The Russian corridor

The Russian case study concluded by recommending the following issues to be recognised and appropriate action taken by all concerned:

- In spite of the fact that there are excessive infrastructure capacities for handling containerised cargoes in the Baltic region, Kaliningrad should aim to develop into a logistic/storage centre. The port should thus serve as transit for cargoes destined for Belarus and the European part of Russia, which includes cities located on the Minsk highway, Moscow and cities 300 –700 km to the south/south-east from Moscow. The cargoes suggested are deep-frozen meat, seafood products, poultry and perishable cargoes – fruit, dairy products with a limited pull date, wines and wine material.
- Kaliningrad is today not competitive on any logistic criteria, except time, regarding transit cargo to Russia, when compared with the Baltic States' transport junctures. To alleviate this situation Russia would have to implement a protectionism state policy. However, development of the Kaliningrad transport juncture can take place without serious investment using the available infrastructure, achieving improvements through perfecting the transportation management.
- Perspective directions for Kaliningrad are container transportation, ferry transportation of trailers without tractor and all options of half-stock supply to Kaliningrad, with partial

processing being made in Kaliningrad (up to the change of the commodity code in the customs) and shipped on to Russia as a ready-made product.

- There are a number of recommendations given in order to speed up the customs work for import to Russia:
    - A customs staff member should enter the ship in the port prior to entering the Port of Kaliningrad and prepare the necessary customs documents. On arrival in Kaliningrad only general examination of cargo is required.
    - At the land border crossings (Russian-Lithuanian, Lithuanian-Belarus) it is necessary to introduce the service to the Kaliningrad carriers, responsible for rendering assistance to hauliers and railway carriers in settling disputable issues that arise while crossing the border. The service is to be available 24 hours and must have an immediate communication with customs management on both sides as well as with the Consulate of Lithuania in Kaliningrad. Status of this support service must be determined by an interstate agreement.
    - As there are queues at the borders between Lithuania and the Kaliningrad region, mainly due to the outlet of private cars, it is necessary that the customs and other services of both states strictly execute international rules related to quick passage of perishable cargoes. At present this is not standard practice.
    - An option of purpose financing of the border crossing capacities at the Lithuanian – Belarus border for provision of accelerated outlet of trailers. In spite of the fact that this border transfer is out of the jurisdiction of the Kaliningrad region, joint financing of the project could ensure preferences for the Kaliningrad hauliers when crossing the border. This is particularly true in case the border transfer obtains a special cargo status.
- As the Kaliningrad region has a special status within the Russian Federation due to its geographical location, it is envisaged to consider the possibility of experimental transition of the Kaliningrad customs to work using the “ASYCUDA++” software product. Lithuania, Latvia and Estonia plan transition of their customs to this product. It is envisaged that utilisation of common software products in the countries of the Baltic area would make it possible to optimise the process of cargo legalisation and simplify the process of following the transit.
- It is recommended that an organisation should be established, which co-ordinates the Kaliningrad transport juncture, having the following functions:
    - Co-ordination of price policy for all links in the transport chain.
    - Survey of the cargo flows in the interests of the entire transport juncture.
    - Development of databases on e.g. cargo volume, cargo owners and competing ports.
    - Co-ordination of work of commercial and state structures, such as documents required for crossing the state border.

There is a need to establish an organisation, which should aim to improve the competitiveness of the Port of Kaliningrad.

There is a need to identify the costs of developing the port into an intermodal transport centre being competitive with its neighbouring ports in the Baltic.

There is a need to develop case specific routes for cargo owners trading between Russia and the EU.

6.2 CONCLUSIONS

The INSPIRE project has carried out a critical review of EU shortsea shipping, developed schemas for examination of transport operations and developed a simulation model for shortsea shipping corridors. The developed models and tools were applied to case studies on Irish, Portuguese, Spanish and Russian corridors.

On this background, a working methodology resulted for the development of innovations on shortsea shipping corridors. The INSPIRE methodology has been shown to handle aspects, such as:

- The development of ship solutions accommodating customer requirements on corridors.
- The assessment of innovations on waterborne transport corridors.
- The assessment of infrastructure developments on waterborne transport corridors.

The INSPIRE project have been carried out over a period of more than two years and amassed vast amounts of data on the four studied corridors. The data has value to more than the INSPIRE partners and possible follow-ups of the project, where the aim is to implement the results, will take place by targeting ship operators and cargo owners.

Policy recommendations are given based on the two-year project work, which are given in a general form on shortsea shipping and in a specific format for the respective corridors. The recommendations are aimed at both industry players and policy makers.

The project comes to a conclusion by specifying the dissemination and exploitation activities, which have been undertaken or which are planned.

The INSPIRE project has lead to various achievements for the individual partners, but in summary it can be said that research and development is the key to innovation in shortsea shipping. By performing research you are not sure to reach your objectives, however, by not performing research you are sure not to reach them.

The generic and transferable deliverables from INSPIRE are:

- A framework for strategic analysis of waterborne transportation.
- Schemas for examination of transport corridors.
- A simulation tool for corridor studies.
- An overall methodology for corridor studies.
- Policy recommendations for shortsea shipping and corridor-specific issues.

The corridor-specific deliverables from INSPIRE are:

- Data and knowledge for the four corridors.
- Identification of innovative issues for the four corridors.
- Identification of further work in order to implement the results.

6.2.1 State of the art review

There has been an explosive growth in shortsea shipping related research during the last years. In this period there have been about 80 papers presented at the three European Research Roundtable on Shortsea Shipping conferences to date (1992, 1994, and 1996). In addition, the three FAST international conferences on fast waterborne transport (1991, 1993, and 1995) presented close to 300 papers, of which about 70 directly focus on shortsea shipping.

Various projects, national and international, have been also initiated in this area. In the context of the 4th Framework Programme, the European Commission/ Directorate General for Transport (DGVII) has launched in early 1996 several shared cost projects, as well as a concerted action explicitly targeted to shortsea shipping. Other directorates such as DGXII and DGXIII have also launched related projects in early 1996.

In view of such a boom of research activity, it becomes imperative to critically survey such work, and also make taxonomy of it, so that all this work is sorted out, and the baseline for further research becomes clear. Failure to do this will inevitably result in duplication of effort, gaps in research, lack of vision on what is needed, and other negative ramifications.

The purpose of this report is to carry out a critical survey and taxonomy of such work. The survey has involved a European-wide solicitation of input on related work, mainly in the context of the “Concerted Action on Shortsea Shipping”, but also from other sources. The survey also presents a software tool developed to assist in information entry, update, and retrieval, and also attempts to identify common trends on research topics.

Without claiming that the contents of the survey are encyclopaedic, or that each and every piece of material collected has been reviewed in depth, we can at least claim that the 441 entries catalogued represent an unprecedented compilation of material in this area. Perhaps the most important trend identified within this vast collection the material is a significant degree of “fragmentation” of R&D effort in the SSS field, in the sense that problems that are methodologically similar in many contexts have been typically addressed in isolation.

The most obvious consequence of this fragmentation is that the impact of R&D efforts to serve the real needs of European SSS has been so far limited. Commission-sponsored activities such as the Concerted Action on SSS, the SSS Roundtable Conferences, the collaborative R&D projects under way, and other related activities are expected to alleviate this situation in the future.

6.2.2 Examination of transport operations

The outputs from this part of the project represent a contribution to the way that many aspects of maritime transport can be investigated and analysed.

At the start of the INSPIRE project there was possibly the perception that WP2 would produce a series of questionnaires which, once distributed by those assigned to the three case studies and recovered with the data requested from carriers, port authorities and others, that the answers on change to ship design or deployment to realise the project’s objectives would somehow emerge. This would always have been an unrealistic approach. The schema as developed, and described in the papers attached, have not been widely used within INSPIRE but have assisted the project nevertheless. A wider benefit is expected to accrue from this work as consortium members and others use the outputs in other applications in the future.

6.2.3 TradseStar simulation model

Transport network modelling has until recently been largely focussed on "microcosms" such as urban city areas or on networks that are well defined with clear unambiguous structures (such as localised rail systems). With the need to better understand intermodal transport and to enable more efficient planning and execution of intermodal transport services, a new requirement has emerged, which poses both a transport and technological challenge never before addressed.

An intermodal system is made up of many other distinct networks (for example road, rail, inland waterway, short sea shipping, deepsea shipping etc.). To realistically model an intermodal network requires a substantial understanding not only of each constituent system but also how each one inter-relates to all the others. The role of the various actors (such as trucks, ships, trains etc.) must be understood and an understanding of how the actors "transfer" from one network to another must be gained. Transfers occur at network crossover points (such as ports, rail terminals etc.) and knowledge of these processes is vital to a realistic model.

TradeStar is an on-going effort to understand the essence of intermodal transport networks and to develop realistic models. TradeStar focuses on providing intermodal network tools that can be used by commercial business and those in the operational aspects of goods transportation. This approach is unique in the intermodal transport sector at this time. Initially the development of IT systems for use with transport networks was slowed by a lack of understanding of the nature and characteristics of those networks. While there is still much work remaining in this area sufficient advances have been made to enable practical and effective systems to be developed. Currently the greatest stumbling block being encountered is gaining access to transport data and resolving inconsistencies with that data. The significance of this problem cannot be over emphasised. All systems developed for transport network analysis rely to a greater or lesser extent on data and consequently the fragmented and inconsistent nature of transport data across Europe is a cause for grave concern. A European wide, consistent and open approach to dealing with the issue is required in the short term.

While IT systems have a crucial role to play in network planning and can assist with a high degree of success in certain areas the TradeStar team have always acknowledged that there are considerations that it is very difficult to quantify and therefore take into account. Many extraneous factors come to bear on what route might be taken by a cargo in any situation such as weather, human factors, political considerations etc. Such a limitation does not however invalidate TradeStar as a tool. Indeed tools like TradeStar have in other fields contributed significantly to an increased understanding of the role of such empirical factors. As computer science and engineering evolves and proposes solutions to difficult concepts such as human factors the TradeStar team will endeavour to incorporate these in the system.

6.2.4 The Inspire methodology - a tool for SSS innovation

The INSPIRE methodology has been illustrated and described in the above. The methodology comprises elements of:

- Strategic analysis.
- Route scenarios.
- Logistic considerations.
- Design criteria.

The INSPIRE project claims that the industry must change from being product oriented to become market oriented and make use of innovation in technology, as well as in philosophy. This can be achieved by adopting the INSPIRE Way, which is illustrated in a simplistic format in Figure 18.

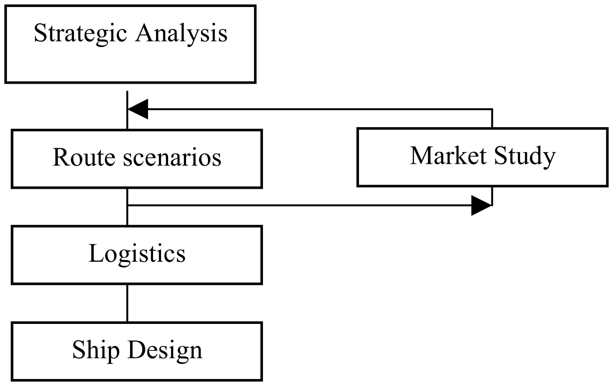

Figure 18: A ship design methodology

The philosophy is that while performing a strategic analysis, information on a studied topic is gathered and stored in a knowledge base. Based on the identified strengths, weaknesses, threats and opportunities the strategic analysis should highlight favourable areas and possible approaches. This should then form the basis for the initiation of a market study on a specific route applying the fundamental knowledge on the topic. The market study will thus conclude upon aspects such as length, payload, and speed. The latter information initiates the design process, which is a mature process and will result in the fulfilment of the market study requirements.

The task in hand is to structure and enhance the information comprised in the strategic analysis and to define alignment between the waterborne transportation entities and attributes and make use of this in an eventual market study. This is the objective of the FAROS project, which is being promoted by LMG Marin. The aim is to develop a decision support tool able to assist the designer in deciding upon the initiating parameters in a ship design process, such as length, speed, payload, etc., thus feeding knowledge back into the early design phase.

Additionally, in a business perspective, the conclusions from the strategic analysis upon strengths, weaknesses, threats, and opportunities can be evaluated in the light of the organisation's business strategy. The information can thus be used to aid a decision regarding investments in shipbuilding, alternatively purchase of existing tonnage, or to refrain from entering the studied market altogether.

7 LIST OF PUBLICATIONS, CONFERENCES AND PRESENTATIONS

7.1 CONFERENCE AND JOURNAL PAPERS

"A Formalised Methodology for a SSS Corridor Study: Western Norway – Continent", I Oestvik, T Wergeland, and A Kroneberg, International Conference Fast Freight Transportation by Sea, London, UK, December 1998.

"A Strategic Analysis of Fast Shortsea Transportation", D Vassalos, I Oestvik, and K Been, International Conference Fast Freight Transportation by Sea, London, UK, December 1998.

"A Strategic Analysis of Coastal and Inland Transportation", I Oestvik, K Been and D Vassalos, International Conference on Coastal Ships and Inland Waterways, London, UK, February 1999.

"Logistical Challenges for Fast Cargo Ships in Shortsea Shipping", T Wergeland and I Oestvik, International Conference on High-Performance Marine Vehicles, Zevenwacht, South Africa, March 1999.

"Waterborne transport corridors", J Mohr and I Oestvik, Shortsea and Shipping Conference, Bergen, Norway, October 1999.

"Fast coastal ro-ro sector: route feasibility methodology", A J Baird and I Oestvik, Sea Australia 2000, Sydney, Australia, February 2000.

"High Speed Craft in Maritime Transport", A C Paixão, Cargo, September 1998.

"Logistics Necessities of Shortsea Shipping Transport Operators", A C Paixão, International Congress Ship and Maritime Transport, Hamburg, Germany, September 1999.

"The problems of imitation modelling of the Kaliningrad Region's Sea Transport Complex", BMA, Scientific article in The problem of development of regional economic, Kaliningrad, Russia, 1999.

"The problems of strategic prognosis of STC of Kaliningrad region", BMA, International forum on the problems of science, technical and education of Academy of Earth Science, Moscow, Russia, April 2000.

7.2 SEMINARS & WORKSHOPS

"INSPIRE Project", J Mohr, Concerted action on Shortsea Shipping, June 1998.

"Waterborne transport corridors", J Mohr, Shortsea shipping conference, Bergen, Norway, October 1999.

"INSPIRE Project", A C Paixão, Shortsea Shipping . An Important Strategy for Portugal, Seminar organised by the DGPNTM, Lisboa, Portugal, September 1998.

"INSPIRE Project", A C Paixão, Innovation Workshop on Transport and Logistics" Seminar organised by the DGPNTM, Lisboa, Portugal, April 1999.

"Transport aspects of SEZ of Kaliningrad", BMA, Seminar organised by Kaliningrad Regional Transport Administration, September/October 1999.

7.3 INDUSTRY AND ACADEMIC LECTURES

LMG has given a number of industrial and academic lectures with regard to INSPIRE. The lectures have been given in Norway, Scotland and Denmark. LMG have had very good response and new contacts have been established and projects have been initiated due to these lectures.

Papanikolaou, A., Zaraphonitis, G., New Technology Ships, Lectures Notes of Postgraduate Course (in Greek), Dep. of Naval Arch. And Marine Engineering, National Technical University of Athens, March 1999, Athens (Greece).

MIR has made project presentations to senior management in the Irish Chamber of Shipping (ICS), Irish Exporter's Association (IEA), Irish Business and Employers Confederation (IBEC), Department of the Marine (DOM), Department of Public Enterprise, Enterprise Ireland. (National Development Authority), European Seaports Organisation (ESPO) in Brussels and Federation of European Private Port Operators (FEPORT) in Brussels.

BMA has used the results of INSPIRE in lectures and practical work in academic disciplines related to management and organisation of sea cargo transport at undergraduate level and in diploma work.