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FLAGSHIP

European Framework for Safe, Efficient and Environmentally-friendly Ship Operations

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D-A1.4.2 Final Report

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Table of contents

1. Introduction

This report presents a summary of work undertaken in FLAGSHIP Sub-project A1. This sub-project started in Month 1 and had a duration of 24 months.

1.1 The Structure of Sub-Project A1

The overall structure of A1 is illustrated in Figure 1. As can be seen in this illustration, the subproject comprises 4 activities:

- Understand the environment
- Define the "As Is" situation (in ship operations)
- Develop future scenarios
- Develop "To Be"

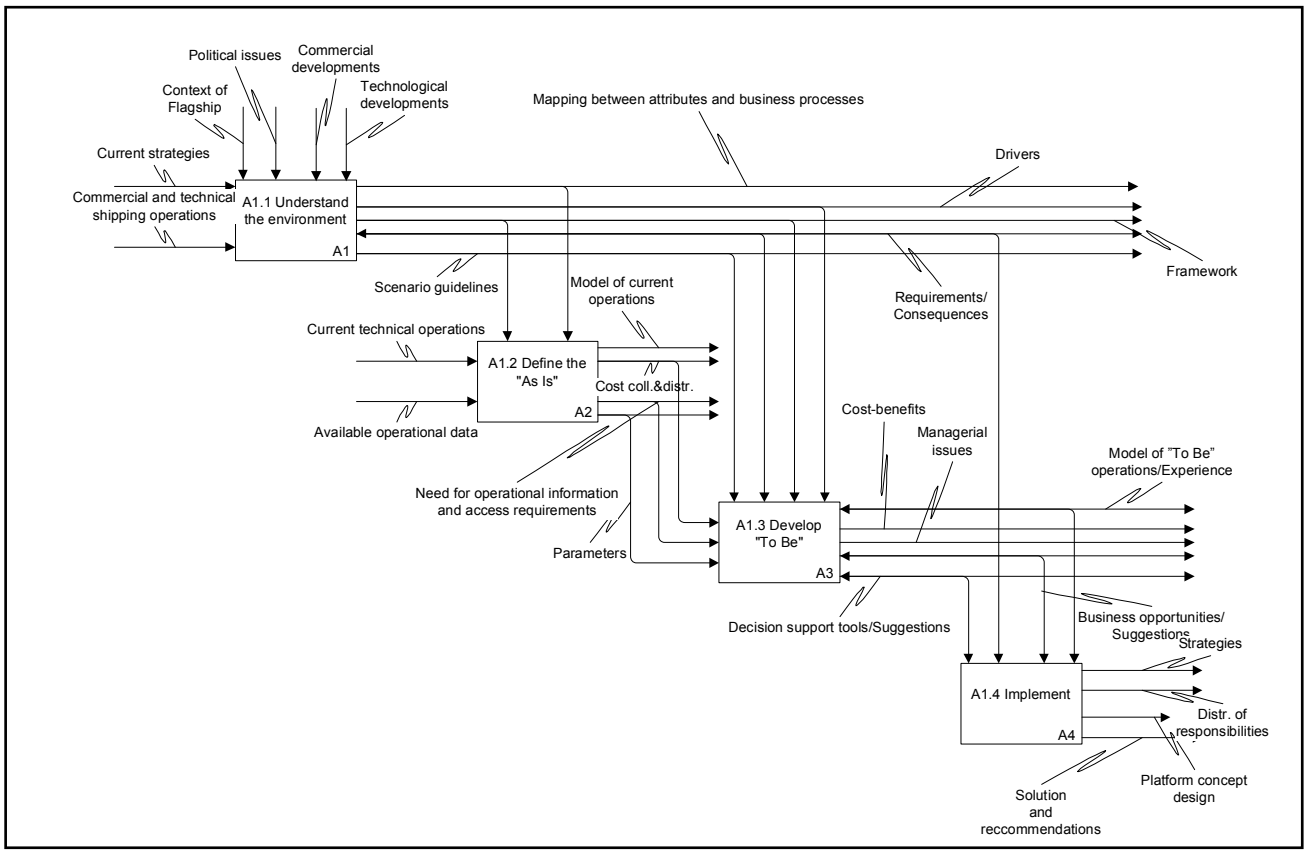


Figure 1 The structure of Sub-Project A1

Sub-project A1 has five deliverables:

- D-A1.1 Requirements Capture Report
- D-A1.2 Define the 'As-Is'
- D-A1.3 Scenario Models
- D-A1.4.1 'To-Be' Process Models
- D-A1.4.2 Final Report (this document)

Each of the first four deliverables is summarised in this report.

2. Requirements Capture Report

2.1.1 Global View

The purpose of the subproject A1 is to develop the technical operational strategy or strategies and supporting logistics that should provide the basis for further developments in FLAGSHIP. The operational strategies need to be developed with the focus on improving safety, environmental friendliness and competitiveness of European maritime transport, which are the overall objectives of FLAGSHIP as a whole.

Ships owned by European ship-owners and operators operating globally, ships operating in European waters (both for intercontinental and intra-European transport) are built globally, and European ships equipment suppliers (who are heavily involved in FLAGSHIP) have a global market for their products. As a consequence, even if the Technical annex uses the term "European maritime transport", FLAGSHIP aims at maritime transport in general.

2.1.2 Port-to-Port not Door-to-Door

Shipping operations are normally integrated in door-to-door transport of people or goods, as illustrated in

Figure 2.

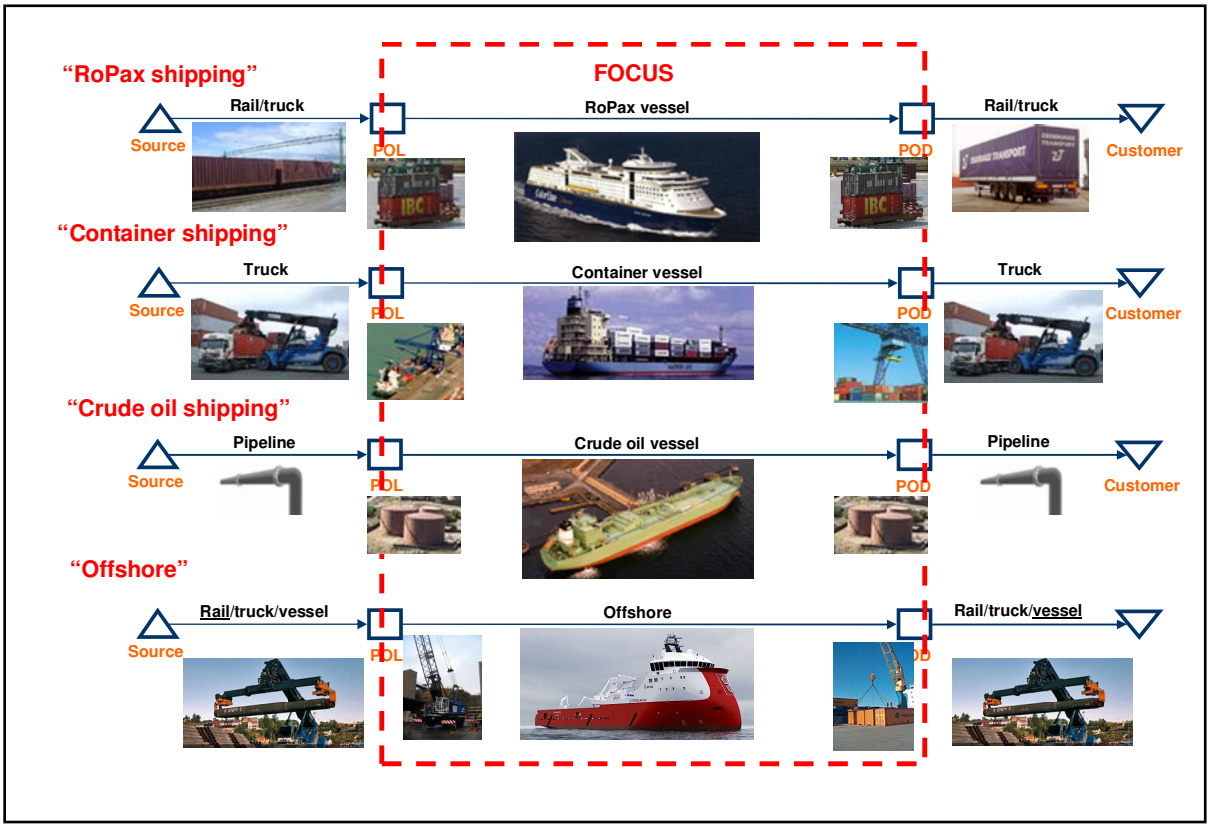


Figure 2 Illustrating the scope of FLAGSHIP

In accordance with the Technical Annex, "the emphasis of the project (FLAGSHIP) is on on-board systems and procedures, ship management systems on shore, impact of new technology on present ship-, owner- and operator organisations, effective and efficient communication interfaces and impact of standards and regulations." Hence, FLAGSHIP needs to concentrate on the activities that can be influenced by onboard systems and by the interaction with the systems and crew onboard and the land-based ship-, owner- and operator organisations. This focus in FLAGSHIP is also illustrated in

Figure 2. The scope of FLAGSHIP is therefore:

- Quay-to-quay operation of vessels
- Loading and unloading of passengers and/or cargo
- Handling of provisions for and waste from vessel operations

2.1.3 Vessel Types

The types of operations that are to be investigated are illustrated by the types of vessels that will be targeted by FLAGSHIP. These are:

- Offshore vessels
- Container ships
- Tankers
- Cruise Liners
- Ferries

These vessel types are also illustrated in

Figure 2, with the modification that there is a combined cruise/ferry vessel illustrated (M/S Color Fantasy), and that the logistics context is one of freight and not of passengers.

2.1.4 Round Trip vs through Life Considerations

The Norwegian research project "Maritime IT Operations"[1] (1994-97) developed the business model for shipping that is shown in

Figure 3, illustrating all the activities in shipping.

At the extremes there are two schools of ship-owners:

- "Asset players" - characterised by looking to build vessels the lowest possible cost within the rules and regulations established by the classification societies and the authorities. The aim is not on vessel operations, but on selling the vessel at a profit when this is possible.
- "Long term operators" - characterised by focussing on operations and building vessels with clear considerations to the through life cost of the vessels, since these are crucial to making the operations themselves profitable.

[1] Maritm IT Drift

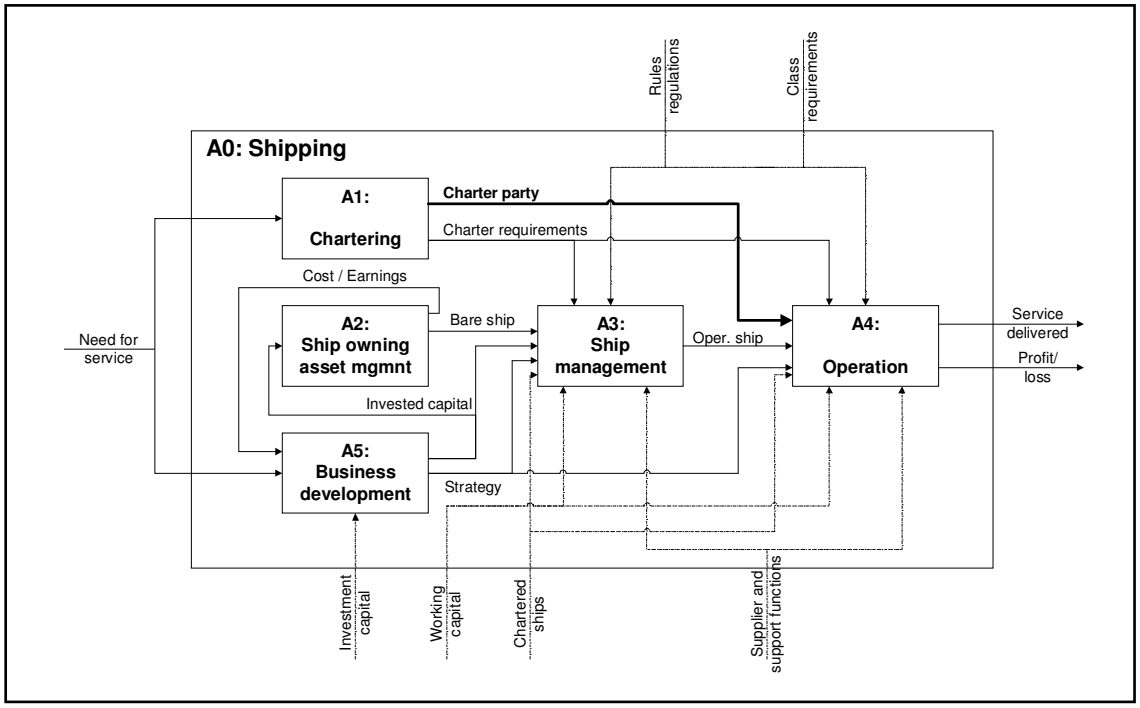


Figure 3 Business processes in shipping

A consequence of the asset play strategy is that a significant number of the vessels that are currently sailing and of those that are about to be built have few or no possibilities of being enhanced in order to improve their performance in the FLAGSHIP areas without new investments.

2.1.5 Linking with Company Strategy

As stated in Section 2.1.1, this sub-project in FLAGSHIP is about technical operational strategy or strategies and supporting logistics. However, Technical operational strategy cannot be viewed independent of all the other activities performed by a shipping company. Hence, a starting point for the activities in A1 is to ensure that we have established:

- Baseline operations (”As-Is”)
- Drivers for change in shipping (for each of the shipping segments that we address),
- Relevant scenarios,
- Strategies (in close cooperation with the involved shipping companies)
- ”To-Be” operations, where technical operations are linked to commercial operations and other relevant activities.

2.2 Key Flagship Attributes

2.2.1 Introduction

As indicated above, FLAGSHIP aims to improve safety, environmental friendliness, and competitiveness in maritime transport. Lord Kelvin is quoted as saying: "If you can measure that of which you speak and express it in numbers, you know something about your subject; but if you cannot measure it, your knowledge is of a very meagre and unsatisfactory kind". As a consequence, FLAGSHIP needs to define ways to measure safety, environmental friendliness, and competitiveness. Before this, however, we need to define what these issues mean in FLAGSHIP.

Fortunately, FLAGSHIP does not need to define these attributes from scratch. Measuring performance is nothing new in shipping. Previous work describes how calculation of Key Performance Indicators (KPIs) can be implemented in state-of-the-art ship (fleet) management systems. Despite this, the project "Shipping KPI", which is an initiative taken by a group of 18 leading ship management companies and ship owning companies (The Sponsor Group) in November/December 2004, was started in order to drive the process for establishing an international standard for KPIs in ship management. FLAGSHIP builds on the results and expertise from this project and related activities. The EU project MOSES, dealing with Motorways of the Sea, also deals with KPIs related to maritime transport. This project will also be consulted in order to avoid duplication of effort and conflicts.

If such measurements shall be of any use, they must be simple to perform and intuitive. FLAGSHIP will therefore strive to establish single "metrics" for safety, environmental friendliness and competitiveness respectively.

2.2.2 Safety

Safety is an area where a number of KPIs have been defined and implemented. Generation of such indicators are already included in commercially available software systems for ship management[2].

FLAGSHIP will "extract" the relevant safety KPIs in order to develop a simple metric for vessel safety. Due to the scope of FLAGSHIP, this will cover ship and personnel safety, where ship safety includes the vessel, its on-board systems/equipment and its cargo, and personnel safety includes the crew and any passengers. Safety aspects (and associated KPIs) of ship building, ship repair, ship scrapping, shore support and port facilities are specifically excluded.

2.2.3 Environmental Friendliness

The ambition in FLAGSHIP is to search for a way to measure the environmental friendliness of a vessel. Environmental issues related to door-to-door transport of cargo and passengers are not the issue in FLAGSHIP.

[2] The ship management system provided by the FLAGSHIP participant DANAOS supports such a capability.

When the metric for environmental friendliness for a vessel is to be defined, it is important that it includes all the elements that are relevant. Some of the key parameters to be included are:

- Energy consumption (both at sea and when berthed)
- Emission to air (NO_x, SO_x, particulates, etc)
- Discharge to water (ballast water, other waste)
- Handling of waste in port

It is suggested that the environmental footprint of a vessel is defined properly in FLAGSHIP. The term carbon footprint has been frequently used when discussing environmental issues for vehicles of different kinds. By limiting this to carbon dioxide only, the real environmental impact of a vessel will not be complete.

The ultimate ambition is to define it such that the footprint can be continuously presented on the bridge (and in the shipping office on land) on the basis of onboard measurements.

2.2.4 Competitiveness

Regarding competitiveness, FLAGSHIP can only relate to cost. Furthermore, as indicated in Section 2.1.4, FLAGSHIP concentrates on operational cost for a round trip (or from port-to-port). In addition, FLAGSHIP should be able to provide input to the ship design process, such that all (designers, suppliers, builders, operators) are aware of what to do to build vessels with low operational cost. In the formula of calculating cost, also the cost of maintenance and prospective refitting of equipment should be taken into account.

2.3 The Structure of the work

The topic of this deliverable is “Understand the Environment”, and the associated activities are illustrated in Figure 4.

This structure is deliberately not followed in this deliverable. The main reason is that the sub projects that FLAGSHIP needs to relate to (in order to ensure that the metrics described in Section 1.2 are meaningful) have time schedules that suggest that these metrics are developed in Activity A1.4. Furthermore, it is in Activity A1.4 that the business models for the future will be developed. Developing the metrics and business models for the future in one activity seems the best alternative. Therefore the metrics will be developed further in Activity A1.4.

The business models presented in this deliverable provide a starting point for A1.2 and A1.3. The structure for Activity A1.1 illustrated in Figure 4 could in principle been the basis for the structure of this report. However, since the detailed development of the Flagship Attributes will take place in Activity A1.4, the work focused on:

- Documenting Business Processes
- Identify Drivers
- Describing the Flagship Framework
- Providing the initial requirements and scenario guidelines for further Flagship activities.

During the first year of the project, the partners identified a significant amount of relevant information.

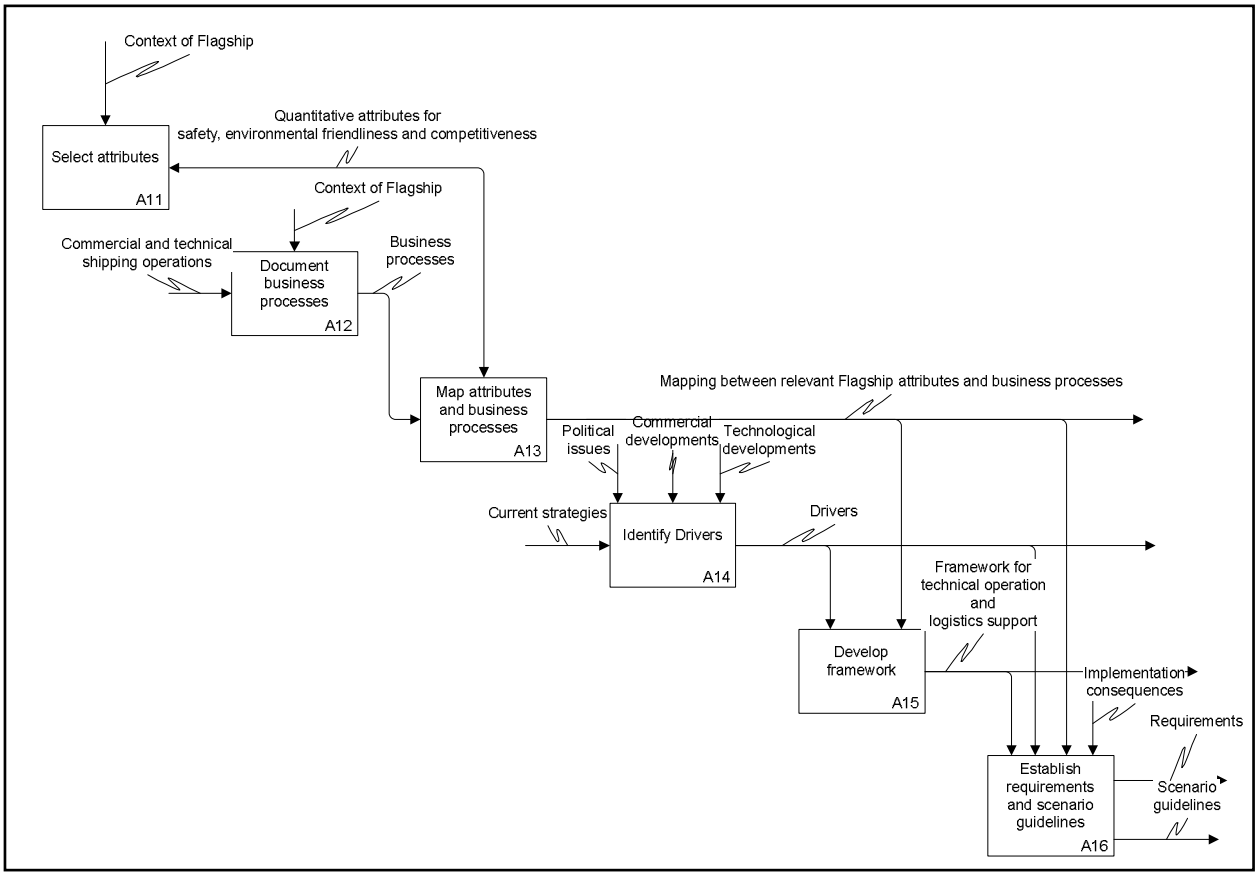


Figure 4 Activities in A1.1

2.4 Summary

The aim of the deliverable has been to understand the environment in which the European shipping industry exists. As such the outcomes of the report are as follows:

- Understand the current operational rationale behind businesses in the European shipping industry
- Introduce a method for measuring business performance
- Identify the drivers for change in the shipping industry
- Establish a framework for further analysing the interaction between stakeholders involved in technical shipping operations
- Detail the ship, shore and support environments that allow this industry to function.

With the high-level strategy of the businesses within cruise, ferry, container, tanker, and offshore shipping outlined, the subsequent step was to establish a formal method for measurement and management of business performance, realising that there is the need for developing a new way of measuring a ship's environmental performance, a ship's ecological footprint. This facilitates a quantitative analysis of the operational aspects of a business in order to identify areas of improvement, which will be covered in later tasks.

After detailing methods for modelling and measuring a business the internal and external factors contributing to a rapidly, and often stochastically, changing business environment were next identified. These 'drivers' were as follows:

- Globalisation
- Business Environment and Competition in the Private Sector
- Climate Change and Environmental Impact
- Operational Cost
- Zero Tolerance on Safety
- New Technology

A case study has been provided that discusses the specific drivers relating to the container shipping industry.

In order to ensure that technical ship management and its interaction with the other activities in shipping can be properly understood by all, the Flagship Framework has been introduced. The framework defines a number of domains in shipping, the associated functions and responsibilities. The framework will be developed in succeeding Flagship activities.

The final sections of the report describe the environment in which the shipping industry exists presently, and is likely to exist in the future. The key shipboard components of this environment were identified as condition-monitoring and remote diagnostics, and onboard automation systems.

The current capabilities of these components and improvements under development for the future were outlined.

The shore-based components of this environment are concerned with the adequate dissemination and analysis of information to aid efficient integration between a business and 3rd parties. A specific example of this has been provided in the case of a ship repair yard.
The final section details the supporting framework in place that allows the European shipping industry to operate, and the developments necessary to meet future requirements. This support structure includes Integrated Logistics Support, the regulatory framework, health, safety and environmental requirements, crew competency and required competence levels, and integrated navigation and communication systems.

With the business environment in which the European shipping industry exists now understood, the industry must now be quantitatively analysed in order to determine the best path to follow for the future. This shall be conducted in the following tasks.

Finally, the main conclusion to be drawn from this study is the rapidly increasing importance of corporate responsibility in all facets of industry. With growing worldwide concern for the environment and mistrust of corporate ethics, it has never been more important for a company to demonstrate high standards of quality, safety and environmental awareness than at the present time.

The introduction of formal processes for demonstration of corporate responsibility throughout all aspects of the industry is sure to reap far-reaching benefits, for example by enhancing reputation and competitive edge. As such this may be a crucial method for producing improvements in the European maritime industry as a key element of the world shipping market.

3. Define the 'As-Is'

3.1 Objective

At the highest level, the overall objective of the FP6 Integrated Project 'FLAGSHIP' is to improve the safety, environmental friendliness and competitiveness of European maritime transport.

Work Package A is aimed at early detection of problems, efficient diagnosis and timely repair, leading to long-term efficiency and savings by optimised monitoring and maintenance.

Sub-project A1 uses Operational Analysis techniques to identify the benefits of new service-orientated business models. These will enable cost-effective management of ship operations, using new processes and technology, informed by best practices in aerospace and land management.

From the objectives to develop a thorough quantative understanding of how information is used in the marine industry today, Task A1.2 is to create value maps derived from a consensus on the value of information in today's operations.

The deliverable presents the work undertaken as part of Task A1.2, incorporating the following vessel types:

- Container Ships.
- Tanker Ships.
- Cruise Liners.
- Ferries.

Offshore vessels are excluded from this study, as none of the FLAGSHIP partners are offshore operators.

The report presents the work in the following sequence:

- An overview of the generic business model.
- A description of the value mapping process and models.
- An assessment of the relative importance of the factors that affect safe, economic and efficient operation.
- An analysis of how operational data is collected manipulated and distributed, by whom the operational information is used, how it is used, and the costs of collecting, distributing and interpreting the information.

The value chain models are based on the SIPOC (Supplier, Input, Process, Output and Customer) model (a methodology commonly used in Six Sigma process improvement work), interviews conducted with container ship, tanker, cruise liner and ferry operators, and the business models reported in the Task A1.1.

Ship operators have got together and agreed definitions for safe, efficient and economic operation, agreed a method to assess the relative importance of those parameters affecting this, and reported their conclusions.

As there is a lot of common ground, the three sub-tasks associated with data collection, manipulation and distribution, access to and use of the operational information, and the costs of collecting, distributing and interpreting the information have been combined into one assessment. A questionnaire has been used to elicit information from ship operators.

Some conclusions are then drawn based on how the work undertaken supports the follow-on task (Task A1.3 – Develop future scenarios), which examines technical operation and management practices in order to consider whether and how ship and land-based related operations could be more cost effectively carried out.

All participants have had the opportunity to contribute their expertise and domain knowledge to all parts of this process.

The deliverable is classed as a 'Demonstrator', and consists of a written report and an interactive PowerPoint file (which contains the value chain SIPOC models).

3.2 Summary

FLAGSHIP Sub-project A1 uses Operational Analysis techniques to identify the benefits of new service-orientated business models. These will enable cost-effective management of ship operations, using new processes and technology, informed by best practices in aerospace and land management.

From the objectives to develop a thorough quantative understanding of how information is used in the marine industry today, Task A1.2 creates value maps derived from a consensus on the value of information in today's operations. The report presents the work undertaken as part of Task A1.2, incorporating the following vessel types:

- Container Ships.
- Tanker Ships.
- Cruise Liners.
- Ferries.

Offshore vessels are excluded from this study, as none of the FLAGSHIP partners are offshore operators.

As part of Sub-project A1, the work reported provides the industry with a framework for assessing today's maritime operations. Underpinning the focus of the report (and the accompanying PowerPoint file) is the concept of the value of knowledge and the understanding of the necessity to provide the correct data, to the correct person, at the correct point in time, in order to maximise operational efficiency.

The report presents the work in the following sequence:

- An overview of the generic business model.
- A description of the value mapping process and models.
- An assessment of the relative importance of the factors that affect safe, economic and efficient operation.
- An analysis of how operational data is collected manipulated and distributed, by whom the operational information is used, how it is used, and the costs of collecting, distributing and interpreting the information.

The business models reported in D-A1.1 Understand the Environment have been used as the basis for mapping the value stream. These have been overlaid with the SIPOC (Six Sigma process improvement) concept, and a consistent set of information maps produced in PowerPoint format.

A common method has been applied across the shipping sectors to establish those parameters than affect safe, economic and efficient operation. These parameters have then been ranked to assess their relative importance. By some margin, 'Reliability of Systems' has the greatest effect on safe, economic and efficient operation.

Shipping operators from all sectors have been polled to establish how data is acquired and how information is used today. The methods of data acquisition and distribution are many and varied, with a range of technologies in use. A few groups of people get to see the information, and the use to which it is put is fairly straightforward and, in most cases, simple. As a result, the associated costs are comparatively low – manual collection, distribution and interpretation, compared to automated collection, distribution and interpretation.

The information maps/value streams will be taken forward for the next task – Develop future scenarios. A line of consistency is developing, from the generic business model, through the sector-specific business model, to the information map/value stream, to a fully developed cost model. It is clear that future operations will increasingly depend on more reliable systems. There are obvious data acquisition opportunities from a drive to more reliable systems – more reliable systems will be less manpower-intensive, so human cost savings from optimising crew numbers can be put into automated systems. More automated systems can more accurately acquire, process and interpret data/information, thereby making the most use of the mass of data that is and will be available for capture.

4. Scenario Models

4.1 Objective

This deliverable predicts future business trends for the shipping industry, focusing specifically on cruise liners, ferries, oil tankers, and container ships using scenario based analysis. Scenario based analysis is widely used amongst large European and US companies to support long-range decision-making. A scenario can be described as the future business circumstances, imagined on the basis of past and present trends, uncertainties, and assumptions. Several scenarios are analysed to identify differing possible futures and the affect key forces have on those futures.

With the FLAGSHIP project having clear connections to safety, cost efficiency, and the environment, the European shipping community have been challenged on the many different ways the future may move towards and what implications this may have for the industry. In order to identify the possible futures of each of the shipping industry segments, a clear grasp of the current state of the industry and how it has reached that point has been ascertained.

5. Current Shipping Industry

5.1 Market History

Market	Definition	Period	Phase/Event
Cruise	Ships regularly used for cruising activities exceeding one day with passengers normally returning to the port of embarkation.	1882-1914	The first routes (Mainly involving crossing the Atlantic)
		1918-1939	The first Caribbean cruises (“Booze cruises” for Americans)
		1945-1965	Extension of cruise areas (Commercial aircraft impact)
		1966-Today	Modern cruise industry expansion (Carnival, RCL and NCL)
Ferry	A ship larger than 1000 GT that sails on a regular line that has passenger accommodation and is using ro-ro technology for the transportation of cars and commercial vehicles (if any)	1862-1885	Ferry Market starts in North America
		Early 1900s	Puget Sound ferry service initiated
		1929	Industry consolidated into 2 companies; Puget Sound and Kitsap
		1935	Strike forced Kitsap out of business
		1929-1950	First Car Ferry, Motor Princess, ran in Canada
		1950-	Fast Growing Car Ferry Industry
		1973	Larger car ferries being build with several decks
		1980s	High speed ferries
		1990s-Today	Ropax vessels
Oil Tanker	Tankers above 10000 dwt	1859-1900	Birth of the oil industry
		1900-1938	Take off period
		1938-1979	Growth period
		1979-2007	Regulatory change, restructuring and renewal
Container	Focused on the Baltic Sea Region, where the market is dominated by a few regional players	1960s/1970s	Operating Agreements
		1980s/1990s	Alliances & Super Alliances
		1990s/2000s	Mergers and Acquisitions
		Today	Still looking for new ways to increase revenues

Table 1 Market History

5.2 The Supply Side

5.2.1 Cruise Market Supply Side

The cruise fleet has been growing at a steady pace over the last 40 years; Figure 1 shows the development over the last 12 years. It highlights the trend of more and larger cruise ships getting built.

The top three cruise companies, Carnival, RCL and NCL (later Star Cruises) have dominated for more than 30 years, company data is summarised in Table 2.

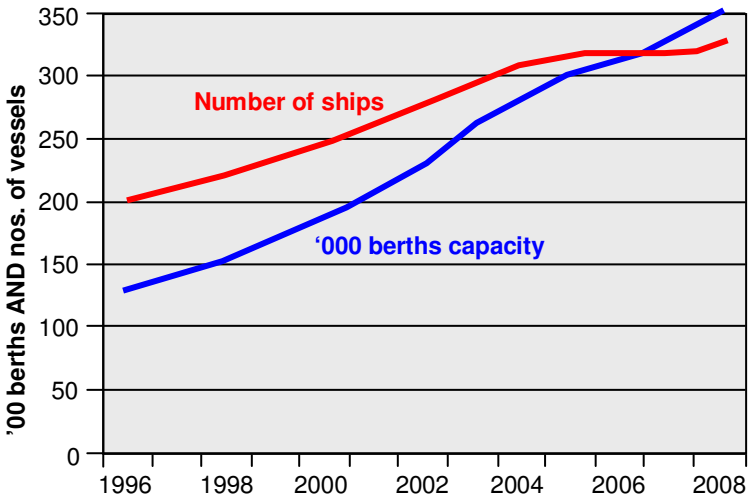


Figure 1 Cruise fleet development 1996-2008

Source: Clarksons, 2008

Group	Nos of Ships	% of Total	Lower berths	% of Total
Carnival	88*	25	169040	44
RCL	41	12	84319	22
Star	14	4	22266	6

Table 2 Top Cruise Owners

The building of cruise vessels is dominated by Finland, Italy, France and Germany, however, the Norwegian company Aker Yards has taken over one French and two Finnish yards.

The current order book for cruise vessels is 44 ships with a total berth capacity of 81590. If the new ships manage to generate new business, the order book is easily in line with demand growth expectations, which are that the industry will continue to grow around 8% p.a.

All top three companies have experienced growth from 2003 to 2006; however in 2006 the growth was significantly less. Carnival comes out as the top performer of the three; however in 2006 the difference between Carnival and RCL is smaller than in previous years.

5.2.2 Ferry Market Supply Side

The ferry industry is both fragmented and diverse; however this does not mean that the companies are without market influence. The ferry industry is totally dominated by local, domestic operators. Stena is the only company with something that resembles an international profile. In this context, the ferry industry is widely different from all other shipping segments. There are indications that it is very difficult to get established outside of the home base. This probably reflects the importance of local political connections, but this is not easy to substantiate.

The five largest ferry companies in terms of passenger capacity have been analysed in Table 3:

Rank	Brand Operator	Ferry	High Speed	Total Passengers Capacity	Ave. no. of passengers per ship
1	Tirrenia	16	4	42589	1638
2	IDO	10	34	29514	656
3	Tallink / Silja Line	14		26891	1681
4	Stena Line	15	4	26511	828
5	Jadrolinija	23	8	20804	671

Table 3 Ranking of European ferry operators by passenger capacity of ships

Source: ShipPax databases 2008

Figure 2 indicates that two companies are highly specialised: IDO with a focus on high-speed passenger and car ferries and Tallink with a clear focus on large overnight ferries with car capacity.

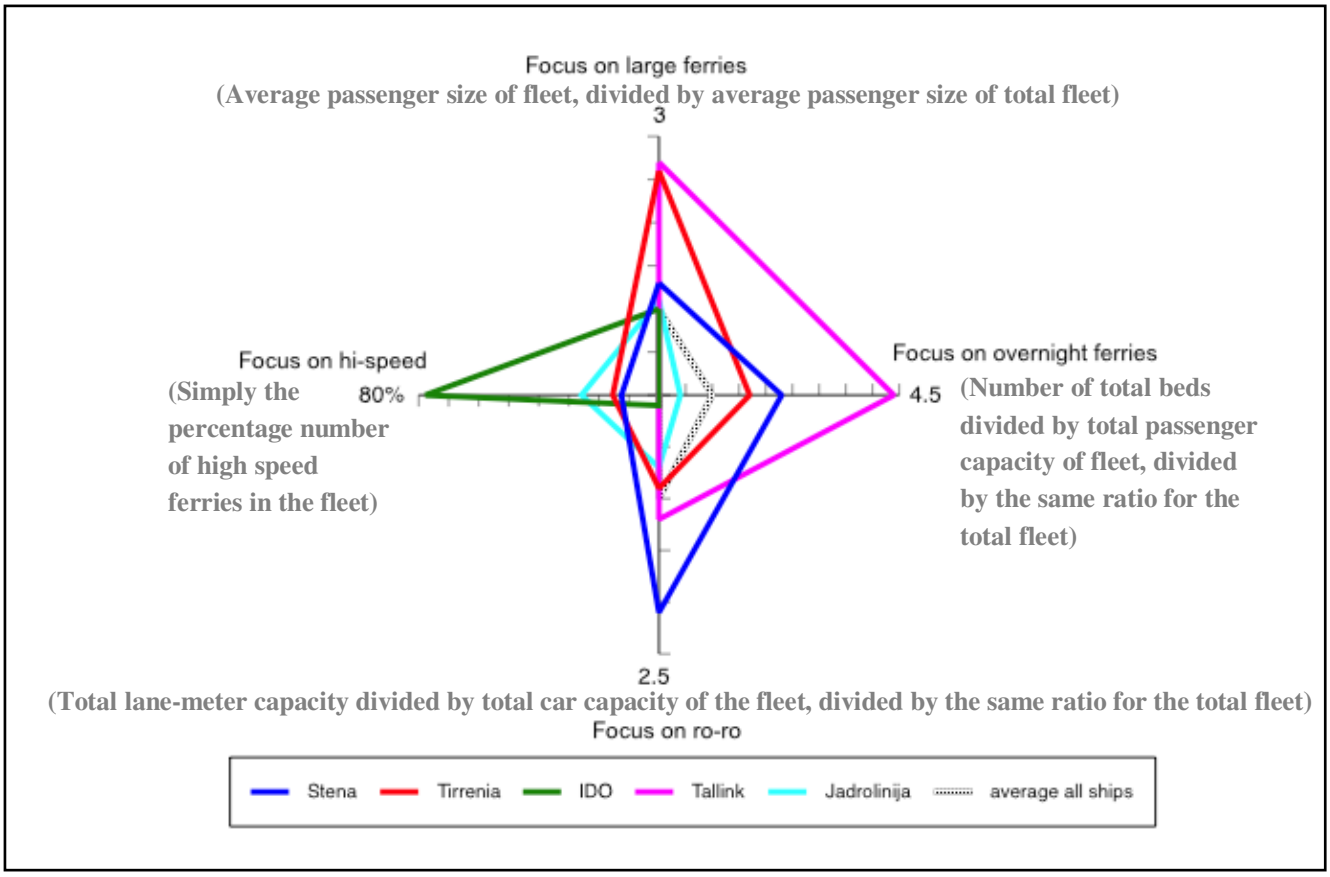


Figure 2 The diversity of the top 5 ferry operators

Source: Based on ShipPax 2008 databases

5.2.3 Oil Tanker Market Supply Side

Tanker shipping is a very fragmented business. In the crude tanker segments Clarkson Research lists 1268 different owning companies or groups. The largest tanker company (Frontline) has less than 5% of the world fleet, so the development towards consolidation seen in most other shipping segments in just in its infancy when it comes to crude tankers.

	All tankers		Crude oil		Product		Shuttle	
Size Category	**Nos.**	**mill. dwt**	**Nos.**	**mill. dwt**	**Nos.**	**mill. dwt**	**Nos.**	**000 dwt**
Handysize (10 - 50)	1761	59.1	102	3.2	1655	55.7	4	157
Panamax (50 - 80)	445	29.3	143	9.6	300	19.5	2	146
Aframax (80 -120)	731	75.3	563	58.3	157	15.8	11	1,129
Suezmax (120 - 200)	348	52.6	318	48.8	2	0.2	28	3,594
VLCC (200 - 320)	490	143.2	490	143.2				
ULCC (320+)	4	1.7	4	1.7				
Total	**3779**	**361.2**	**1620**	**264.9**	**2114**	**91.3**	**45**	**5026**

A summary of the oil tanker fleet at the beginning of 2008 is given in Table 4:

Table 4 The tanker fleet as of 1.1.2008

Source: Fearnleys 2008b

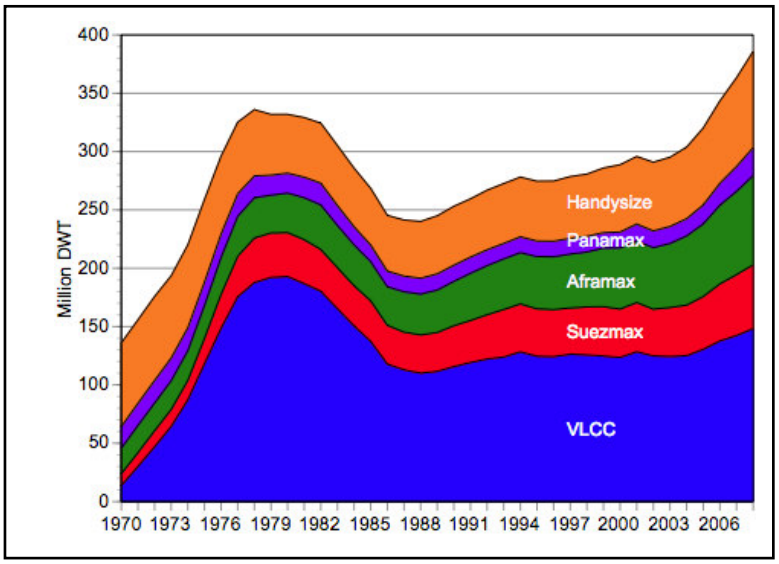


Figure 3 shows the tanker fleet development from 1970 to 2008. It was not until 2005 that the tanker fleet reached a similar level as the peak level of 1978, some 27 years after. The current high growth levels raises the question of whether the supply development is better aligned with demand expectations this time.

Figure 3 Tanker fleet development 1970-2008

Source: Clarksons, 2008

In the tanker industry, environmental regulations are forcing ship owners to scrap older vessels and build new ones, having an impact on the future order book. The tanker industry will get 6 per cent and 9 per cent new capacity in 2008 and 2009 respectively, to be matched by the development on the demand side.

5.2.4 Container Market Supply Side

There has been significant growth in the container fleet over the last 15 years with a marked development towards very large vessels, culminating with the delivery of the 13500 TEU Emma Maersk in June 2006. The top five operators in the global container business are as follows:

		2006			2000		
Operator	**Country**	**Rank**	**Ships**	**TEU Capacity**	**Rank**	**Ships**	**TEU Capacity**
Maersk Line	Denmark	1	484	1.573.551	1	244	599.601
MSC	UK/NL	2	320	1.019.725	5	122	233.751
CMA-CGM Group	Switzerland	3	167	517.213	9	61	138.956
Hapag Lloyd	France	4	136	454.526	17	26	89.076
COSCO	Germany	5	134	390.354	6	114	201.263
World Container Cellular Fleet				**9.135.749**			**5.150.000**

Table 5 Top 20 Shipping Lines in 2006 and 2000 ranked by TEU capacity

Source: Review of Maritime Transport 2007, BSR Liner Shipping Report, 2006.

The container ship order book shows an extreme increase relative to the existing fleet in the 10000+ TEU segment. Ships in excess of 6000 TEUs are also popular with the exception of the 7000 -> 7999 TEU segment, with only six new ships on order, mainly because of design issues, as one can get a bigger ship for about the same price.

Container transport in the Baltic Sea Region (BSR) is experiencing significant growth and is the fastest growing shipping segment, in particular due to the Russian economy becoming more and more open for world trade and general economic growth in Lithuania, Latvia, Estonia, and Poland (i.e. increased demand for manufactured goods).

Due to the considerable growth in world trade, the increased demand for waterborne transport capacity has resulted in ship-owners and shippers ordering larger and larger tonnage ('jumboizing' of vessels); both as a means to reap economies of scale, but also in order to counter the fluctuations in increasingly pressured freight rates.

5.3 Demand Side

5.3.1 Cruise Market Demand Side

The Cruise industry is a young industry characterised by a highly diversified demand.

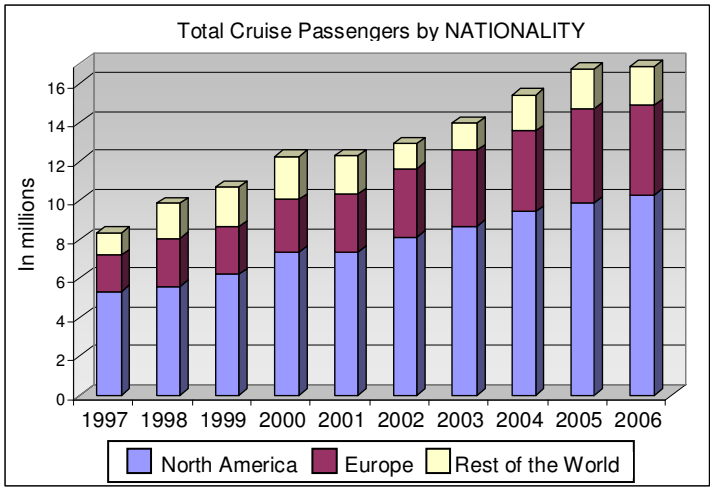
Segment	Product	Customer
Contemporary	Typical 7 day cruises, but also shorter • Mainly in the Caribbean	Mostly new cruisers • Some cruise lines have returning customers
Budget	Shorter Cruises • Often much entertainment • Intensive price competition	Much younger customers • Lower middle class
Premium	Longer Cruises • Many and varied destinations • More onerous cruises	More experienced cruiser • Much older middle class customers
Luxury	Very onerous Cruises • Often on smaller boats, and sailboats. Europe biggest market (then Alaska)	Rich people
Special	Many categories • River Cruise biggest • Other types: exploration cruises and globe trotting cruises	Mix of many varied customers.

Table 6 Market Segmentation of the cruise industry

Sources: CLIA 2007 and ECC 2007

The length of Cruises seems rather uniform over time, the most common being one week in North America, and one or two weeks in Europe. The cruise market is constantly expanding, but is still young in terms of market penetration.

Geographically, most North American cruisers buy a cruise in North America, and most European cruisers choose Europe as destination. The biggest market segment is North American cruisers in the Caribbean - around 38% of passengers worldwide (MARAD 2007), the second being Mediterranean attracting mostly European cruisers, then North Americans (ECC 2007). Asian cruisers show similar behaviours as Western countries, however, there is still much to learn about their preferences and needs in terms of vacations, which might represent a new segment for cruises.



The main areas of expansion of the cruise industry are North America and Europe as seen in Figure 4. The European market is a more recent phenomenon, but has increased constantly during the last two decades.

Figure 4 Evolution of North American and European Cruise markets

Source: Clarkson 2007

The mass-market phenomenon (Dickson, 1993) that has affected the cruise market resulted in a significant decrease in average age and wage level. This radical change has taken place thanks to the offer of shorter duration cruises (three or four days) that are more suitable for the younger segment of the population, with regard to both available leisure time and disposable income.

5.3.2 Ferry Market Demand Side

The demand side of the ferry market is extremely fragmented, very similar to the aviation industry. Ferry passengers consist of individuals and families buying their tickets through a multitude of different channels, so there are no dominant players one can identify in this market. The ferry industry is a very important one in the world economy carrying close to two billion people and over 250 million cars, buses and trucks per year.

The success of a ferry operation will depend on how well the actual service matches the underlying demand in the area under consideration. Figure 5 is an attempt of illustrating the complexity of demand motives.

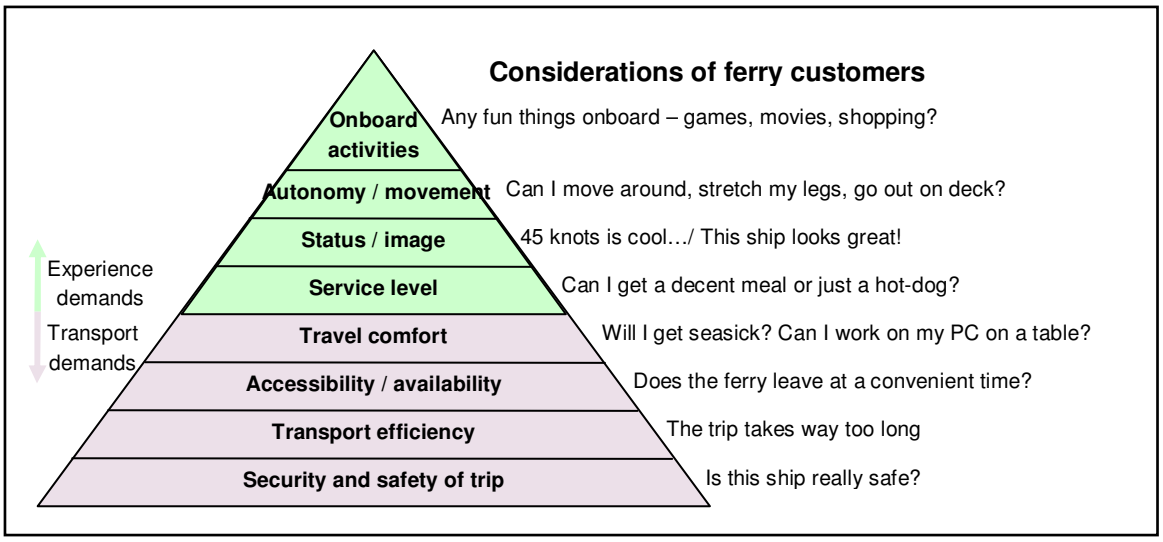


Figure 5 Hierarchy of ferry demands

The basic demands must be met first, i.e. is it safe, will it take me where I want to go? If the target groups are holiday travellers, people who would go more for the experience itself, the other part of the hierarchy becomes more important.

5.3.3 Oil Tanker Market Demand Side

The tanker industry lives from carrying oil from exporting to importing areas. The demand for oil transportation will thus depend on a few key parameters: The resource base – reserves for oil, total demand for energy, distribution of demand on energy sources, developments in producing and exporting areas, and distance implications of trade patterns.

OPEC has played an active role in changing the oil prices by controlling the output of the organization's member production. This led to an oil price shock in 1973 and again in 1979-80. The role of OPEC seems very much the same today as in the mid 70s.

Since 1995 the use of oil has been reduced from 40 to 36 per cent, with smaller changes for the other sources of energy. China and India rely to a great extent on coal for fuel, and although China has reduced the share of coal from 76 to 70 per cent, in absolute terms China has more than doubled the use of coal from some 500 mtoe in 1995 to almost 1200 mtoe in 2006, an increase that is dwarfing all attempts of reducing CO2 emissions in the rest of the world.

The International Energy Agency expects the world oil demand growth to be 1.3% on average for 2005-2030, with 2.5% growth in developing countries and only 0.6% in the OECD area. China will continue to have high growth rates of energy demand (3.4%).

Some regions are net exporters and other regions are net importers of oil, and this regional imbalance is what creates the international trade flows in oil. The view is that North America, Europe and China will have more dominant import areas in the future, with Japan and India as followers, all with a very high share of crude imports in their total oil consumption. This oil will increasingly have to come from the Middle East and Russia as the dominating net exporting regions in 2030.

5.3.4 Container Market Demand Side

In recent years there has been an extreme increase in container trades in the BSR, both inter regional trade as well as import and export from outside the BSR. While the world container port traffic has increased by 8.5 % p.a. in the period 2000-2006, the Baltic ports reported an annual growth of 13%. (Clarksons 2007b). The demand for container transport in the Baltic region has been triggered by high economic growth, increase in trade and consequently increase in transport demand. The BSR is a region characterised by a mix of one group of very rich countries and one group of very fast growing countries, with growth rates comparable to that of China.

The trade volumes of the BSR countries are expected to develop positively and the growth in exports of the BSR countries from 2003 to 2020 is expected to be slightly higher than the growth in imports. One driving force behind this expected growing trade will be high trade growth between Russia and Germany as well as between Poland and Germany.

Demand in container transport is not only influenced by globalisation and international trade, but also by logistics patterns established by transport cargo owners and freight forwarders. The resulting effects on transport are: increase of the average transport distance, concentration of flows on links and nodes, and optimisation in the use of transport resources.

5.4 The Demand and Supply Balance

5.4.1 Cruise Market Demand and Supply Balance

Cruise shipping is the only shipping sector where the supply creates its own demand. The current order book constitutes almost 30% of the existing fleet and is to be delivered over the next four years. Figure 6 illustrates the development of market balance by showing growth rates of demand and supply.

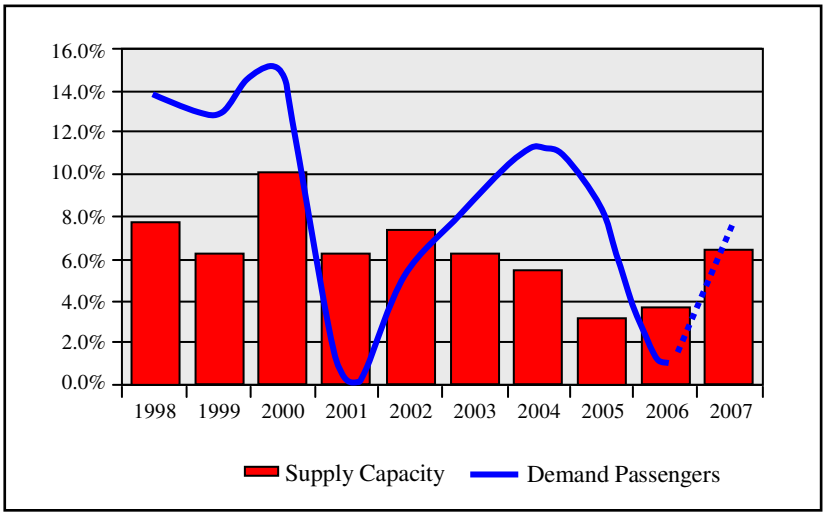


Figure 6 Yearly growth rates of cruise demand and supply source

Source: ShipPax 2007

Cruise ships in the mass market are getting bigger and bigger. In addition to the challenge of securing a sufficient supply of vessels in a fast growing market, it will increasingly be a challenge to find new destinations and to develop port and terminal facilities with sufficient capacity to accommodate the increasingly big ships.

5.4.2 Ferry Market Demand and Supply Balance

The traditional approach in market analysis of comparing demand growth rates with expected supply increases makes only very limited sense in the ferry market unless it is coupled with information about where new capacities are planned to be employed.

The order book indicates that 36 new ferries will be delivered in 2008, which are eight more than in 2007. The growth in lane-meter capacity is expected to exceed 4%.

Route patterns are not static, and in 2007 the market saw seven routes closing down, one in the Baltic, two in the North Sea and four in the Mediterranean, but no less than 14 starting up, 11 of which in the Mediterranean, with IDO (domestic), Grimaldi (Italy-Spain) and Moby (domestic) opening one new route each.

5.4.3 Oil Tanker Market Demand and Supply Balance

There are two main characteristics of the tanker market: it is highly cyclical in nature and the freight rate variations are in periods extreme. These features can be seen as a reflection of the underlying structure of supply and demand in this market, and the fact that freight rates always will reflect the balance of demand and supply forces. The demand for tanker transportation is very inelastic. However, the supply side is more complicated, because the supply of tankers is affected by oil prices, i.e. the price of bunker oil.

The supply will shift out with some 6-9 per cent per year the next couple of years, while demand only will shift some 2 per cent, maybe 3 per cent if Middle East and West African exports increase more than other exports. The market balance will deteriorate, and freight rates will be pushed downwards. The high bunker prices will prevent the freight rates to go as low as was seen in the early 1990s.

5.4.4 Container Market Demand and Supply Balance

The container market in the BSR is experiencing significant growth and deep sea operators such as Maersk and MSC are extending their network into the region by deploying ‘low capacity vessels’ being considered as too small for efficient deep sea operations.

The expected growth in TEU capacity for 2008 and 2009 is around 13-14% per year, or slightly higher than the expected demand growth of around 10% per year. The growth will be particularly high for the larger vessels, which means that one should expect that the capacity utilisation rates will go down for the larger vessels. This will most likely lead to some structural changes, one of which is that the global operators will try to push what used to be very large vessels (but are now quite small) down towards the regional feeder markets. Over-contracting of large vessels may, therefore, be bad news to regional operators.

5.5 Competition and Market Structure

There are two main economic dimensions that determine the economic structure of a shipping segment: On the one hand the potential of exploiting economies of scale and on the other hand the potential of differentiating the service from that of competitors, as illustrated in Figure 7.

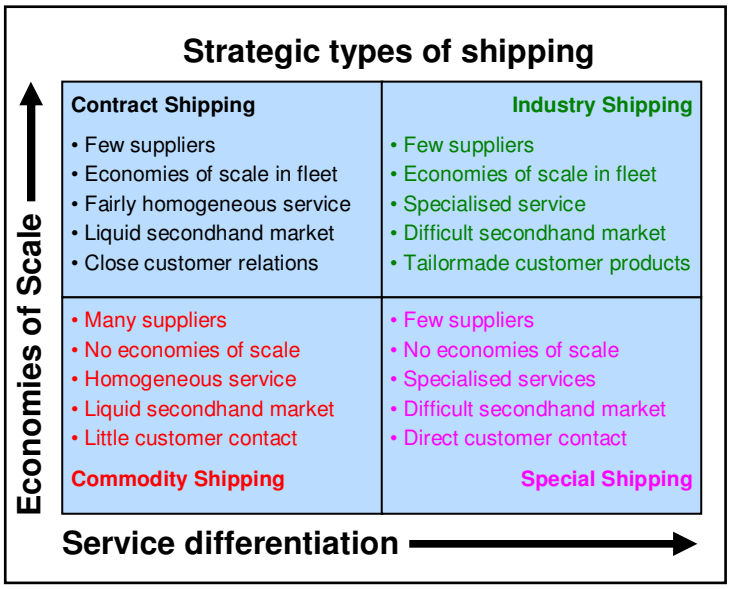


Figure 7 Strategic types of shipping

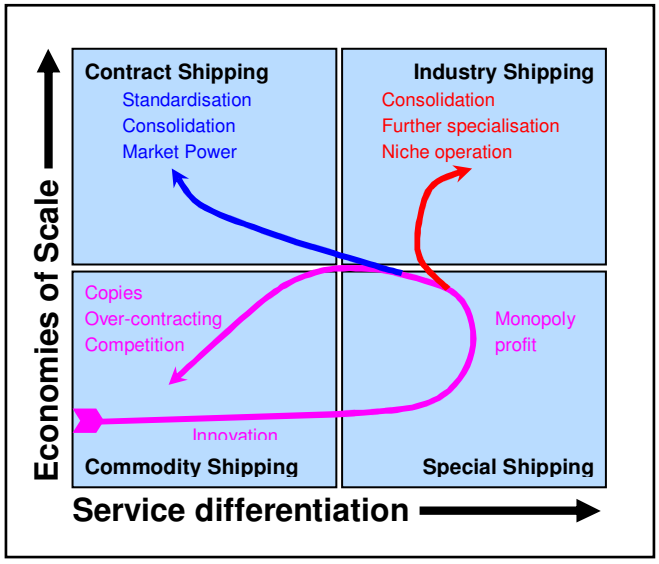


Figure 8 Shipping Segments

A typical development is that innovations (often made by people or money from the commodity shipping segment) create some new speciality shipping, which is further developed into either contract shipping or industry shipping. There are also many examples of new special shipping segments that return to commodity shipping because of quick copying of the ship concept and over-contracting. This is illustrated in Figure 8.

5.5.1 Cruise Market Competition and Market Structure

The Cruise industry is an oligopoly with five dominating firms (Carnival, RCL, Star, MSC, and Apollo), but with a fairly large competitive fringe. Since each ship can be considered a concept, it is possible for small firms to operate within niches. It is more than likely, however, that if these niche operations are highly successful, the companies will be targets for acquisitions by the larger companies.

The cruise industry is basically a concept industry, where each vessel could be regarded as a unique concept. The marketing of concepts demands vast resources, not only in PR and advertising, but in networks of travel agents, and size is here extremely important.

The key to continued success in the cruise industry lies with these two dimensions: Constantly finding new ways of exploiting economies of scale and constantly introducing concepts in the market in line with markets needs.

5.5.2 Ferry Market Competition and Market Structure

The ferry market is a very fragmented market, but unlike the tanker market, that exhibits all signs of being a pure competitive market, this is not the case for ferries.

The market structures for the many ferry routes are dynamically influenced by innovations and competition, and competition can come not only from other ferry operators, but also from competing sectors in the bigger business of moving people, like the airlines.

5.5.3 Oil Tanker Market Competition and Market Structure

Tanker shipping is a prime example of a segment where there are no apparent economies of scale, nor much room for service differentiation.

In fact, the tanker industry fulfils all the four main criteria for being a market in pure (perfect) competition:

- No single player can exploit market power.
- No room for specialization and there is just one price.
- Perfect information about prices.
- No entry or exit barriers.

5.5.4 Container Market Competition and Market Structure

There are several factors that make the container market complicated, but three of the most important factors are:

- The context in which the containership is used
- The geographical focus
- Ownership vs. chartering of tonnage

The global container industry is still fairly fragmented, but there are some fast growing companies coming up to challenge the leader, and if more mergers take place among the top three it will no doubt attract the interest of the competition authorities.

5.6 Industry Attractiveness

Industry attractiveness for cruise liner, ferry and oil tanker markets can be broadly split up into seven factors; barriers to entry, competitors, product similarity, switching costs, demand growth, fixed costs, and barriers to exit.

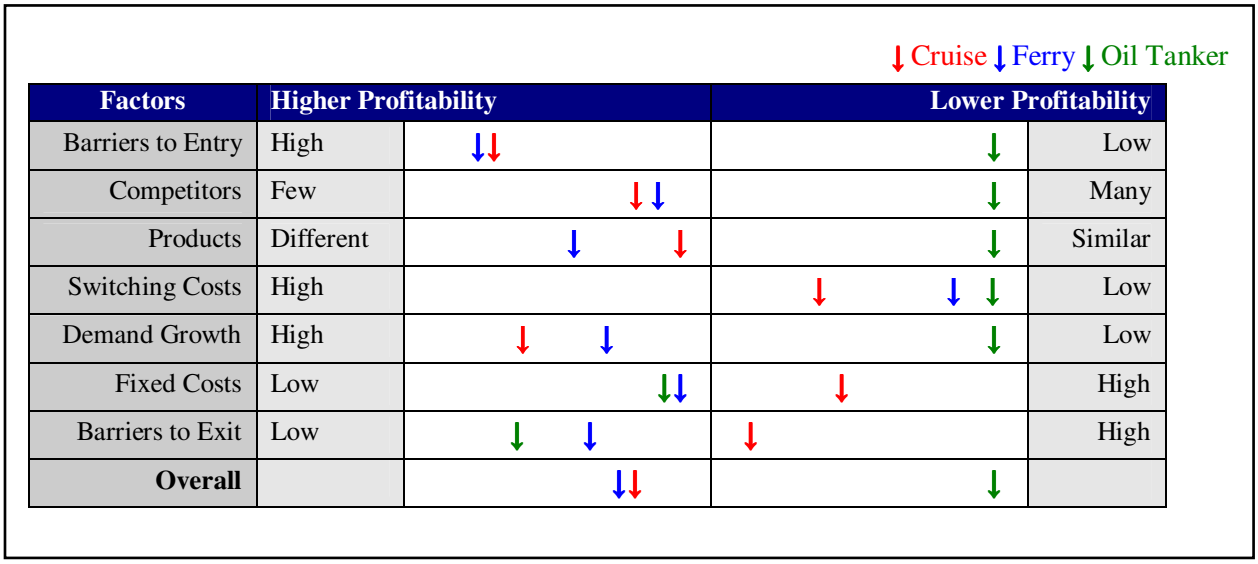


Figure 9 Cruise, Ferry, and Oil Tanker industry attractiveness

From Figure 9, both the Cruise and Ferry industries seem quite attractive, in contrast the oil tanker industry stands out as being very unattractive. The oil tanker's unattractive industry can be attributed to the cyclical nature of the business and the correspondingly high fluctuations in both earnings and values of the assets.

The container industries attractiveness maybe split up into five competitive forces: barriers to entry, threat of substitution, bargaining power of a company's suppliers, bargaining power of buyers, and intensity of rivalry among existing competitors. With the exception of the bargaining power of suppliers, the five factors indicate a rather unattractive business.

5.7 Critical Success Factors

Industry	Critical Success Factor
Cruise	Exploitation of economies of scale
	Differentiation of the cruise product
	Developing customer loyalty
	Managing strategic investments
Ferry	Developing the right local (political) connections
	Handling the complex match of demand requirements and the choice of technology
Oil Tanker	Active asset management, i.e. successful timing of decisions
	Low cost operations
	Superior market understanding
	Flexible and scaleable organisation
Containers	Strategic networking with key global container operators
	Offering customers added services to increase customer loyalty
	Branding activities

Table 7 Critical Success Factors

6. Future Shipping Industry

Having analysed the current state of the industry segments, future business circumstances can be forecasted using scenario-based analysis.

6.1 Scenario Process and Methodology

The process of developing the scenarios for each of the shipping industries involved brainstorming about influence factors and future scenarios, and identifying external drivers for change in each industry. The applied scenario process and methodology is illustrated in Figure 10.

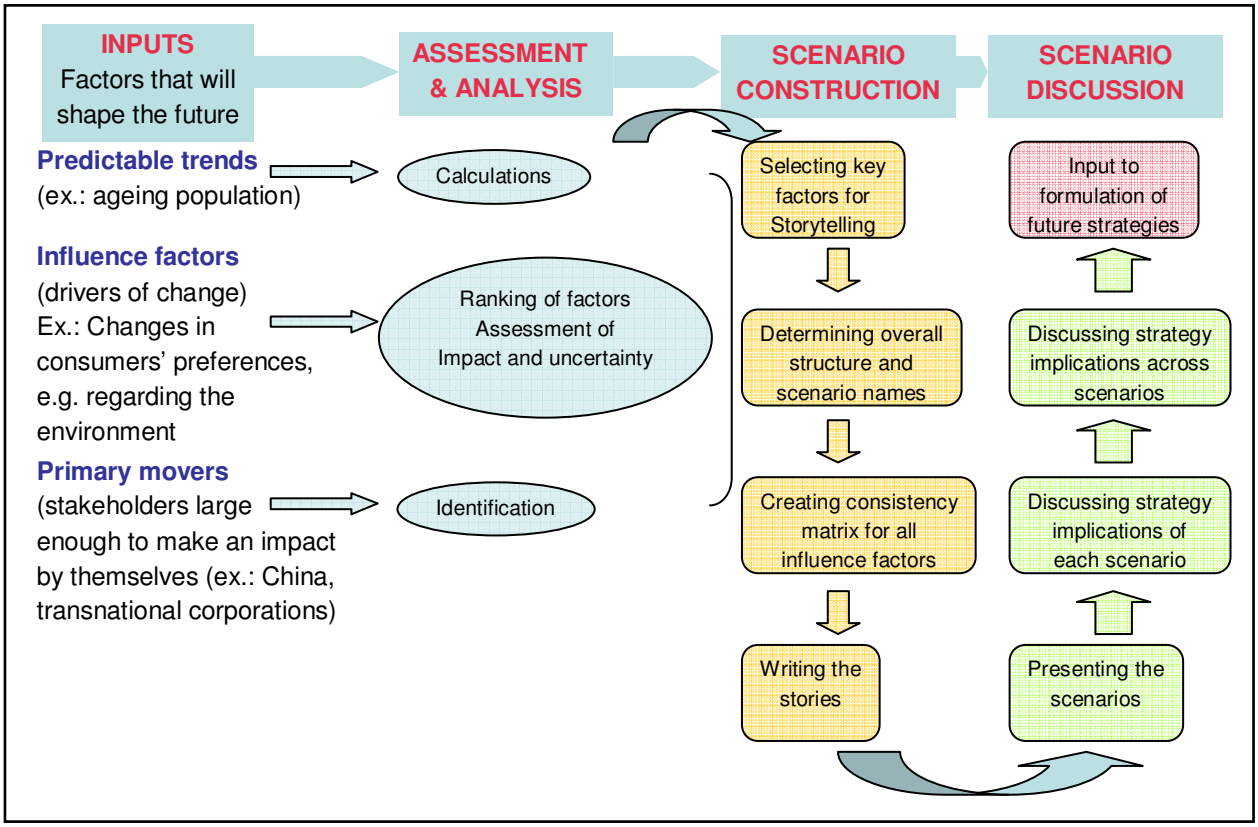


Figure 10 Scenario Process and Methodolody

The most important drivers for change in each category were identified and categorised by the degree of uncertainty and impact they may have. Table 8 shows the key drivers for change in each shipping industry. The colour of the text in Table 8 identifies the driver category specified by Figure 11. Furthermore, drivers having both high impact and high uncertainty are highlighted with a grey background.

Energy prices, alternative energy sources
Attitude changes: Environmental concerns
Economical/political stability, Asian power, regional politics
Specific regulation, infrastructure investments
Technological innovations
Crew availability
Segment specific factors

Figure 11 Drivers for Change Key

Rank	Cruise	Container	Tank	Ferry
1	Oil Prices	Russian politics/regulations	Oil Price (incl. Role of OPEC)	Oil Prices
2	Availability and quality of crew	Global taxation on use of fossil fuel	Backstop, non-fossil energy sources. Role of Oil Majors.	Transport policies
3	Passengers perception of sustainability	Growth scenario (Baltic Sea Region)	Pipeline/On/Offshore infrastructure investment	Alternative energy sources
4	Environmental regulations	Infrastructure investments – ports	Automation: TSS – Total Safety Sail (E-navigation, global communication)	Infrastructure investment
5	Economies of scale	Infrastructure investments road rail	Regulations of emissions	Ship design
6	Regional Conflicts/Acts of Terrorism	Customer perception on competitiveness/efficiency	Climate Change. Regulations/taxation of use of fossil fuel;	Environmental concerns
7	China / India Effect	Customer perception – environment	Ship & Transport system design	ICT; automation
8	Safety and Security Regulations	Technology: automation	Role of US and Asia in global economy	Fossil fuel taxation
9	Pressure Groups Activities	Technology: cargo handling	Average distances/Trade routes	
10	Shortage of Destinations/Port Facilities		Availability of Crew/Quality of Crew	
11			Wars; Regional conflicts; Banning exports/imports	

Table 8 Key Drivers for change in each shipping industry

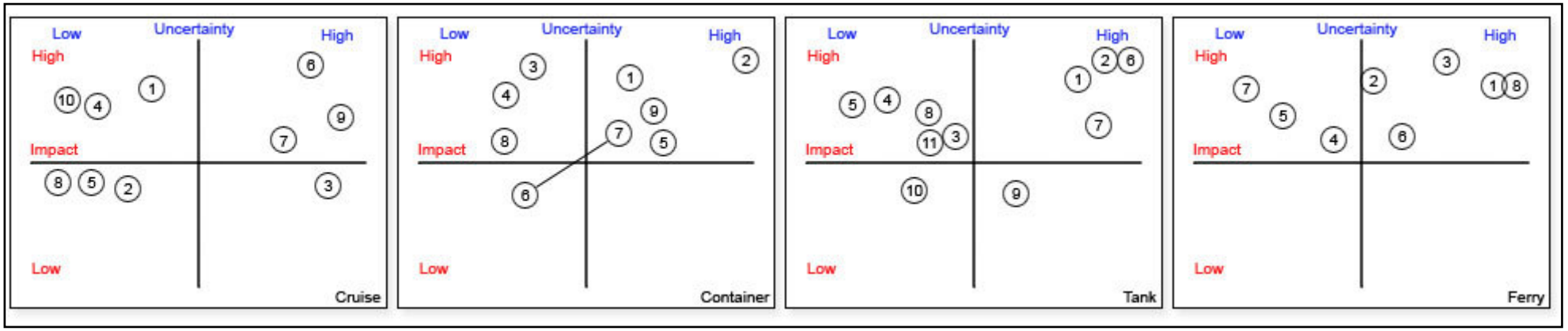


Figure 11 The key influence factors' degree of uncertainty and impact

Four macro scenarios were produced to identify two global factors and two extreme possible outcomes, for the future shipping sectors. By combining these two dimensions, four possible, fairly extreme scenarios for the future global development were constructed, as indicated in Figure 12.

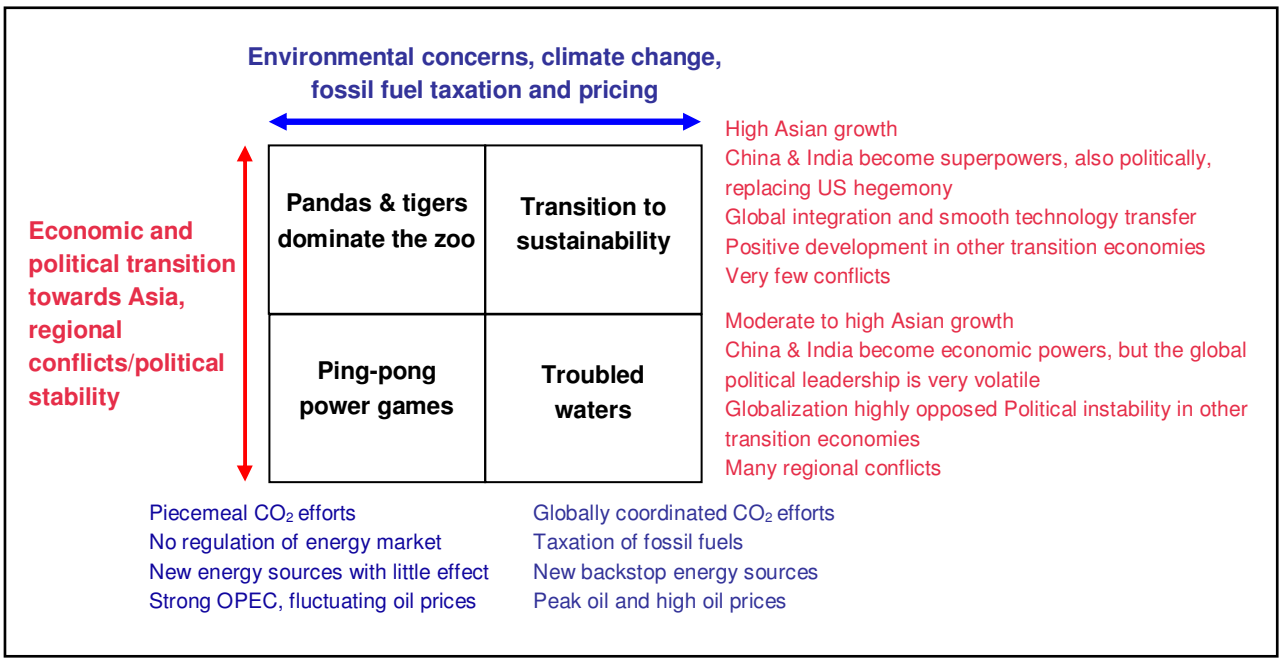


Figure 12 Macro scenarios

Each scenario is detailed in Table 9:

Pandas & tigers dominate the zoo	China has become an economic superpower • India surpassing Chinas growth rates • China and India active members of UN and WTO • Global Environmental Crisis • Oil prices fluctuating
Ping-pong power games	World is suffering from a lack of international leadership • Russia positioning itself as a political power but struggling with local conflict • No positive developments on environmental issues • Middle East conflicts on the verge of international war • Oil prices showing extreme volatility
Troubled waters	World is suffering from a lack of international leadership • Global taxation scheme for fossil fuels sending oil prices sky high • Positive Environmental effects with engines based on non fossil fuels • Chinas communist rule under threat • Shortage and imbalance of food distribution and shortage of clean water • Countries on the brink of going to war over water
Transition to sustainability	High emergence of alternative fossil fuels • UN Stronger than ever • Terrorism and conflicts are almost unheard of • USA the leader of international research • Asia is the growth centre of the world • Economic inequality, poverty and hunger, lack of clean and sufficient water

Table 9 Scenario Descriptions

6.2 Segment Specific Scenarios

Figure 13 shows a presentation of the market specific scenarios.

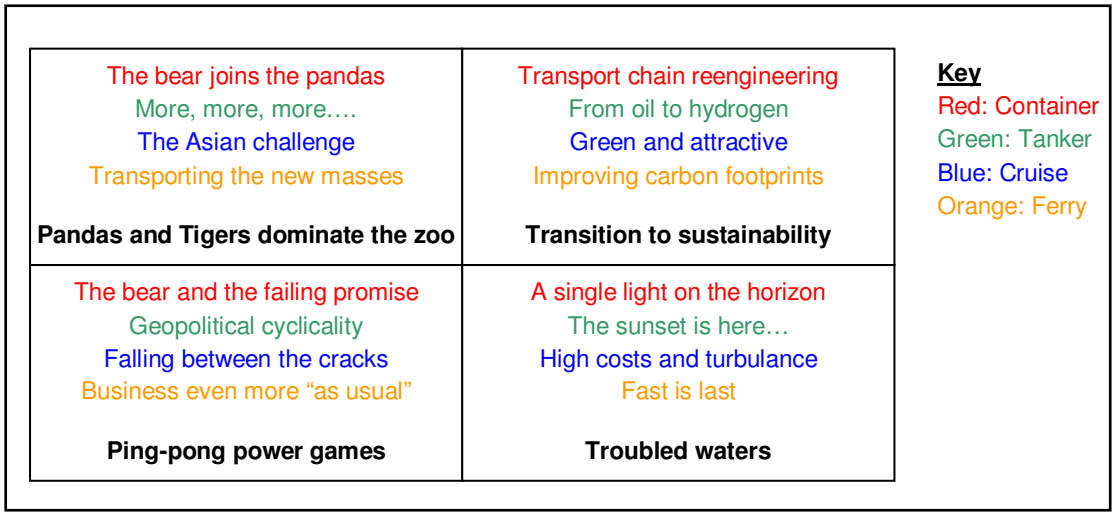


Figure 13 Market Specific Scenarios

6.2.1 Container Scenario

The bear joins the pandas	Significant Asian market growth • Little new technology developed • No focus on environmental issues • More cargo moving from Europe to Asia
The bear and the failing promise	High fluctuating oil prices • Political instability • Asia national unrest • Russia supports internal growth • Economies of scale support shipping operations • Increased Baltic activity • No focus on environmental issues
A single light on the horizon	High oil price • Political instability • Poor transport demand • No infrastructure development • Government supports sea transport • Black sea region is a significant competitor • New energy types introduced
Transport chain reengineering	Sustainable supply chain gains foothold in the industry • Importance of efficiency • New technologies in cargo handling • new energy types and propulsion technologies introduced

Table 10 Container Scenario

6.2.2 Tank Scenario

More, more, more….	Strong economic growth in Asia • EU, US, Japan experiences stabilisation in energy demand • Little innovation • Crew access problems • Russia focuses towards Asia
Geopolitical cyclicality	High fluctuation of oil price • Manageable crew situation • No new technologies
The sunset is here…	Resources viable for exploration • Huge oversupply • Large taxation of fossil energy • Few triggers of innovation
From oil to hydrogen	Transport of oil declining • Focus on Hydrogen as new fuel • Efforts put in place to produce Hydrogen • Needs for Hydrogen vessels • Huge Investments and high profitability • Temporary shortage of crew • Positive Environmental focus

Table 11 Tanker Scenario

6.2.3 Cruise Scenario

The Asian challenge	Asian market gains importance • Industry not flourishing • Increase in power of big players • Ship as destination will be more promising
Falling between the cracks	Fluctuating demand for cruise services • No appeal of environmentally friendly concepts • Market open to regional operators • No real economy of scale • Segments suffering from recession
High costs and turbulence	Costs of cruises make them less attractive • Falling demand • New environmental regulations • No innovations in ship design or concepts • Less money spent onboard • Innovation of more ports
Green and attractive	Shipbuilding industry in Europe • No economies of scale • Smaller vessels gain foothold • Green vacation alternatives • Short term crew availability problem • Not affected by environmental regulations

Table 12 Cruise Scenario

6.2.4 Ferry Scenario

Transporting the new masses	Asian market experiencing high growth • Asian ferries differ from European • Uniqueness of each route • No political unrest or trouble • High growth in China
Business even more "as usual"	Focus on uniqueness of each route • Fluctuating demand • Political instability
Fast is last	High bunker price for ferries consuming high volumes of fuel • Transport policy favours shortsea shipping
Improving carbon footprints	Requirements for new lower speed concepts • Transport policy reflects total social costs

Table 13 Ferry Scenario

6.2.5 FLAGSHIP focal points and macro scenarios

The three FLAGSHIP 'pillars' ranked according to industrial importance are as follows:

1. Cost Efficiency
2. Safety
3. Environmental Friendliness

Figure 14 represents a way of interpreting the macro scenarios in relation to the FLAGSHIP framework.

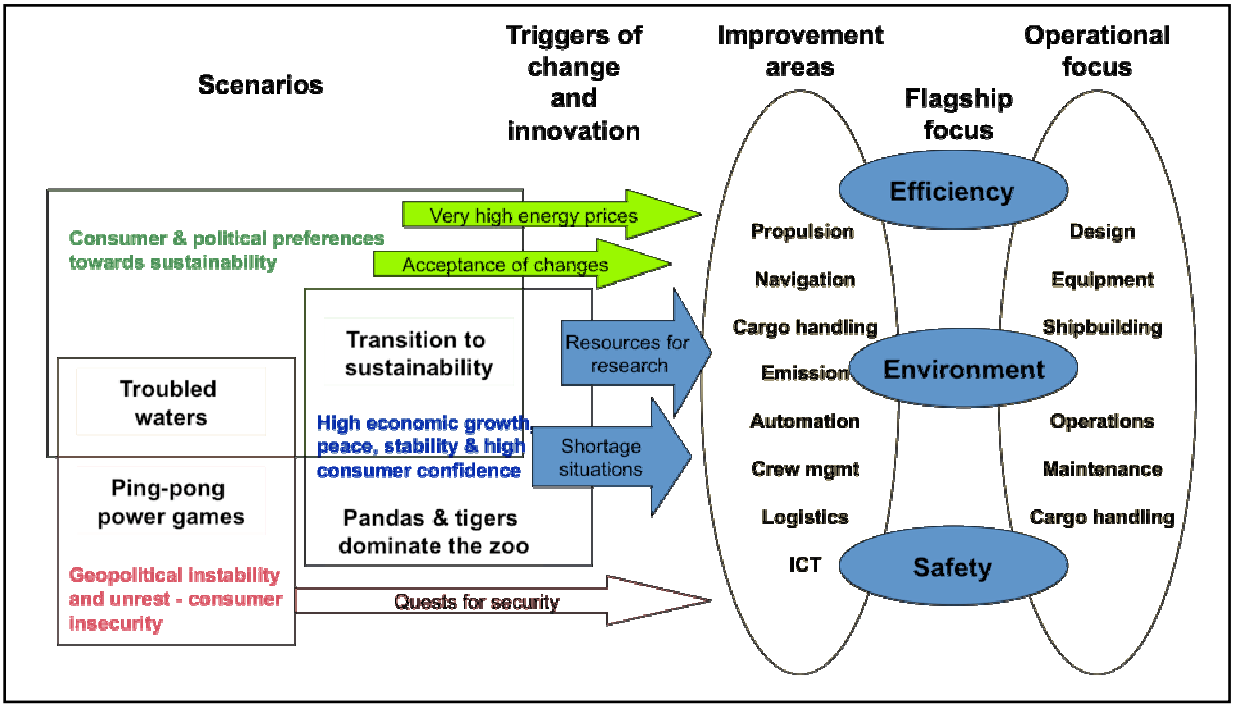


Figure 14 Flagship Framework

For Security, Cost Efficiency, and Environmental Friendliness, the ship needs one operation system that is integrated, understood, and improved, as well as the right management and qualified crew in order to make the system work.

7. 'To-Be' Process Models

7.1 Objective

On the basis of the findings from the previous tasks, this task develops a generic "To-Be" business model for shipping operations. This is developed on two forms:

1. A generic model that may form the basis for configuration to the context of any possible shipping operation, and the agreed cooperation between shipping operator resources onboard and on land, plus agreed cooperation with external resources, including equipment suppliers.
2. Adaptation of this model to two sample operations among those represented in this sub-project.

7.2 Summary

The deliverable provides a generic model for shipping operations. The context for the model is illustrated in

Figure 15. The model provides detailed presentation of running ships and maintaining or repairing them.

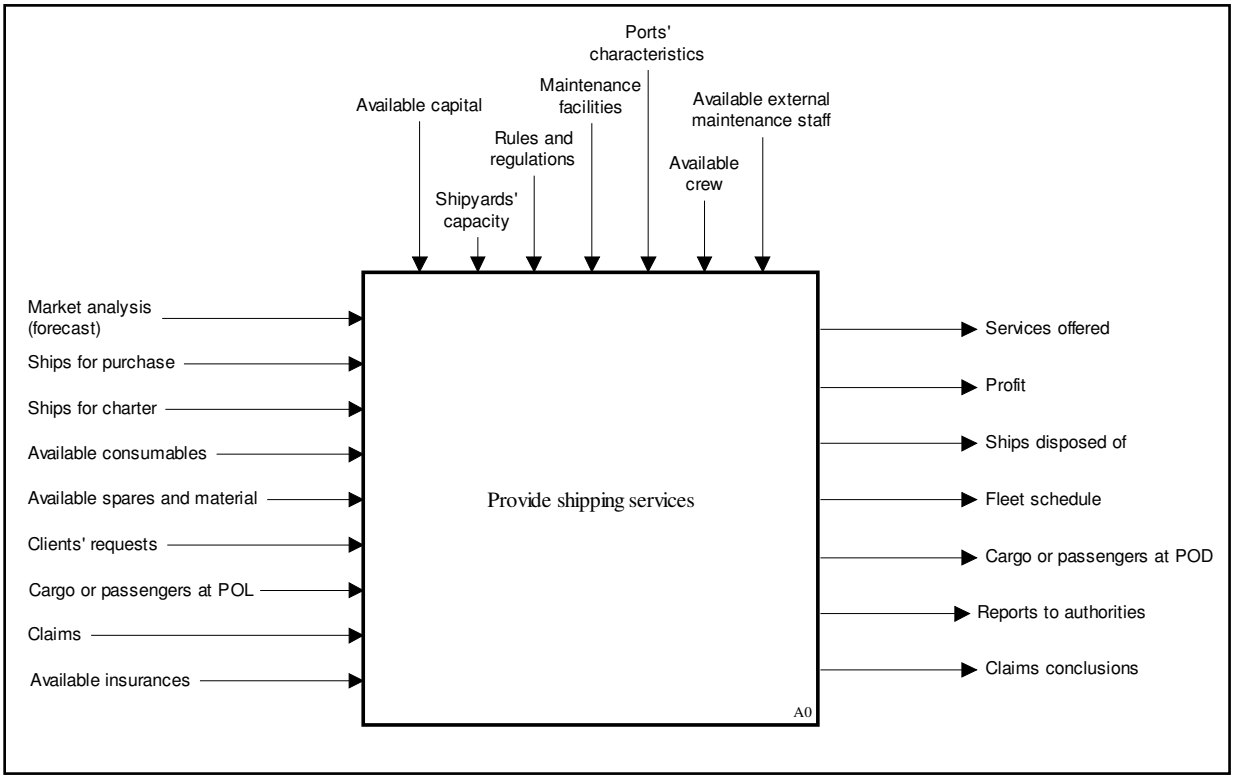


Figure 15 The context for providing shipping services

The model is generic in the sense that it concentrates on functions, information needed to perform functions and the information that is being produced. Examples are also provided as to how the model may be adapted to the actual operations of shipping companies, then indication which organisation may be responsible for which function (using maintenance and repair as an example).

The model provides a starting point in situation where shipping and equipment companies may discuss new approaches in ship operation and management, where the equipment suppliers may be taking a greater responsibility for ensuring the availability of the capabilities provided by the equipment in question.

7.3 Starting Point

During the discussions on strategies and drivers for change, Meyer Werft presented their view of the interaction between actors throughout the life of a ship. This is shown in Figure 16, and presents one view into the operational life of a ship. However, other organisations may paint a different picture, just because they are looking at the same process from a different point of view.

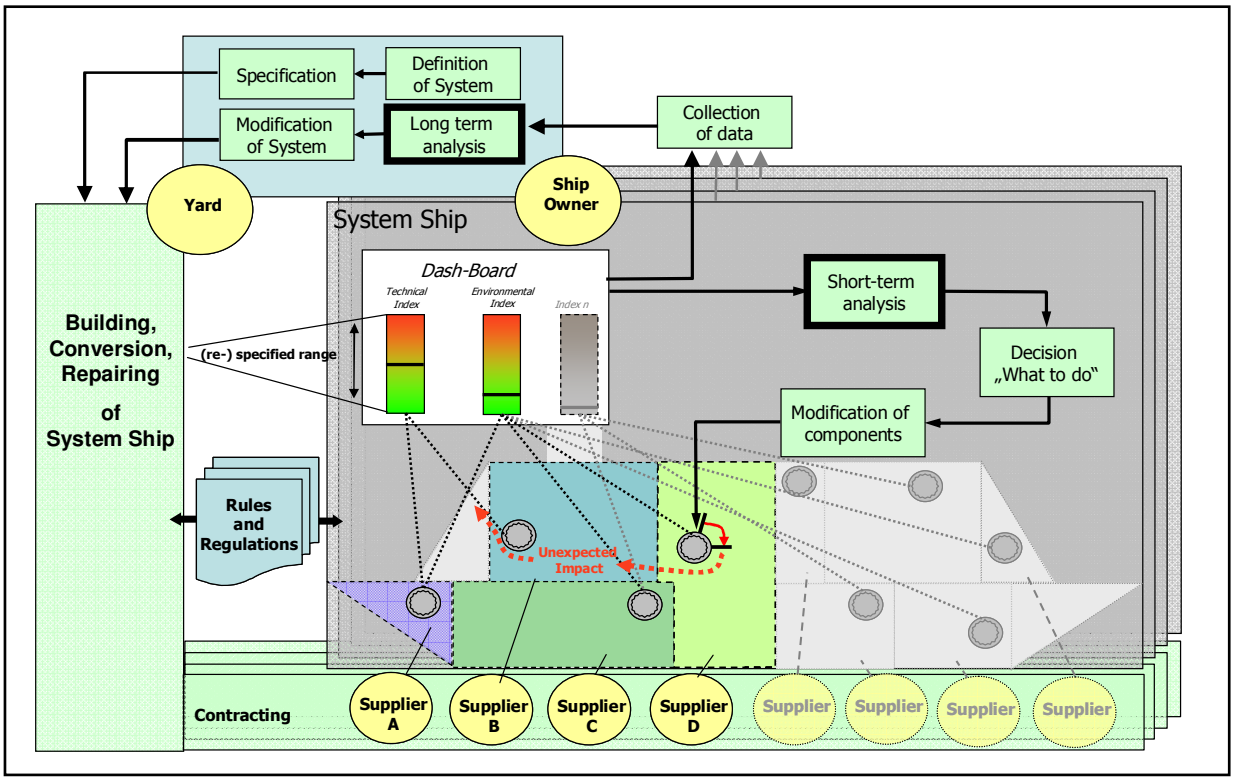


Figure 16 Meyer Werft's view of interaction between actors throughout the life of a ship

In order to ensure that FLAGSHIP contributes to creating a better understanding of how all the stakeholders involved in shipping operations should be able to contribute in a setting where the total result is the best possible for all involved (that the tasks – functions – that need to be performed are distributed among the stakeholders such that these are utilised to their maximum potential), FLAGSHIP develops a generic "picture" of these functions and the interaction between them. This picture is focussed on functions and not on organisations. The distribution of functions between stakeholders may vary from situation to situation.

The overall objectives of FLAGSHIP, being to increase competitiveness, safety, and environmental performance of shipping operations, are very much dependant on the interactions between the respective parties that are involved in performing in performing the appropriate functions. Since the parties that perform a specific function may vary, the focus here is on function, not on who is performing the function.

7.4 Generic Business Models

At the highest level, the overall objective of the FP6 Integrated Project 'FLAGSHIP' is to improve the safety, environmental friendliness and competitiveness of European maritime transport.

Work Package A is aimed at early detection of problems, efficient diagnosis and timely repair, leading to long-term efficiency and savings by optimised monitoring and maintenance.

Sub-project A1 searches for new, flexible service-orientated business models that may be used to create win-win for those involved in ship operation, repair and maintenance. These will enable cost-effective management of ship operations, using new processes and technology, inspired by best practices in aerospace and land management.

The key objective of Task A1.4 is to propose a new way of organising the maritime transportation industry using advanced automation techniques and associated universally agreed operating procedures. This is not possible to do on a general basis, but an example is being presented in the second part of this deliverable.

The types of ships that are represented in FLAGSHIP and the type of operations that are examined related to the description of this deliverable are:

- Container Ships.
- Tanker Ships.
- Cruise Liners.
- Ferries.

Operations, including repair and maintenance, for these types of operations may differ. As an example, a cruise vessel has a tight schedule and needs to be self sufficient. Hence, a number or maintenance or repair activities need to be carried out by the ship's crew, which has to be educated and staffed to do so. Ferries, on the other hand, dock so frequently that maintenance and repair may be performed by shore based staff.

What is special for the model that is being presented here is that it is generic. The fact that it is sanctioned by representatives for these types of shipping operations and the remaining participants in subproject A1 confirms its generic capabilities.

To illustrate how the model may be adapted to different types of operations and, hence, shipping companies, this deliverable shows how selected elements of the model may be adapted to cruise and intra-European container shipping. It also discusses the possibilities of introducing new relationships between ship operator and equipment suppliers and/or shipyards, where functions for maintenance or repair may be outsourced more than is currently normal.

It is important to note that the business processes presented here have been discussed by organisations operating and maintaining these types of ships. The models have also been exposed to others with experience from a wider range of shipping operations. Hence, seen from the shipping operators' point of view, these business models are considered to be quite generic.

7.5 Link to Real Life

It is not the intention of this project to force a special way of organising shipping operations on anyone. In a sense it may better be thought of as a checklist for what to take into account when organising shipping operations and distributing responsibilities between those actors that are to be involved to ensure that no task is forgotten and that the exchange of information between those that are carrying out the different functions is necessary and sufficient, such that all functions may be carried out efficiently.

Some reflections on moving tasks between ship and land are discussed.

7.6 'To-Be' operations

Business models are displayed graphncally, using a consistent notation, and each parameter identified is fully discussed. The business model starts with a top level 'Provide Shipping Services' function. This is subsequently decomposed into four functions:

1. Develop business
2. Manage assets, acquisition and disposal
3. Manage commercial operations
4. Operate ships sustainably

Of these, 'Manage commercial operations' and 'Operate ships sustainably' are the most relevant to FLAGSHIP objectives, and these are the two studied in more detail in the report. This is illustrated in Figures 17, 18 and 19.

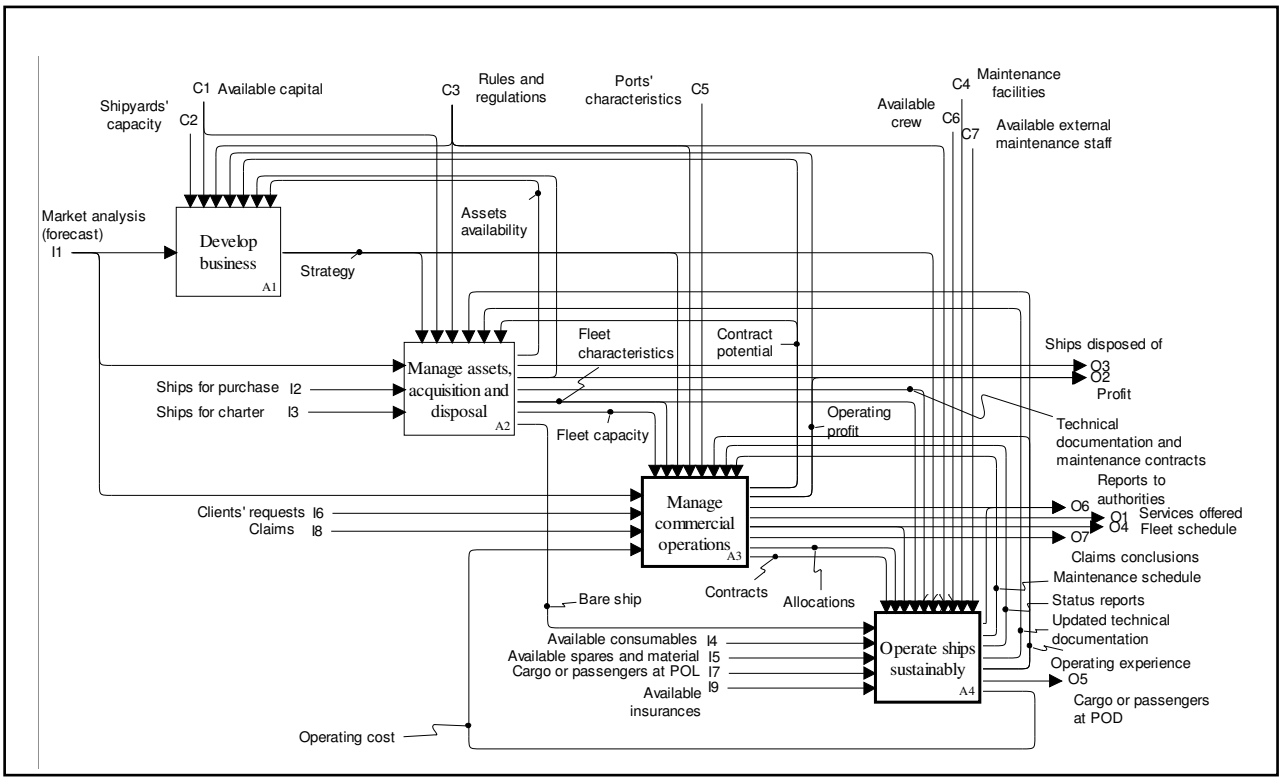


Figure 17 Top level FLAGSHIP shipping model

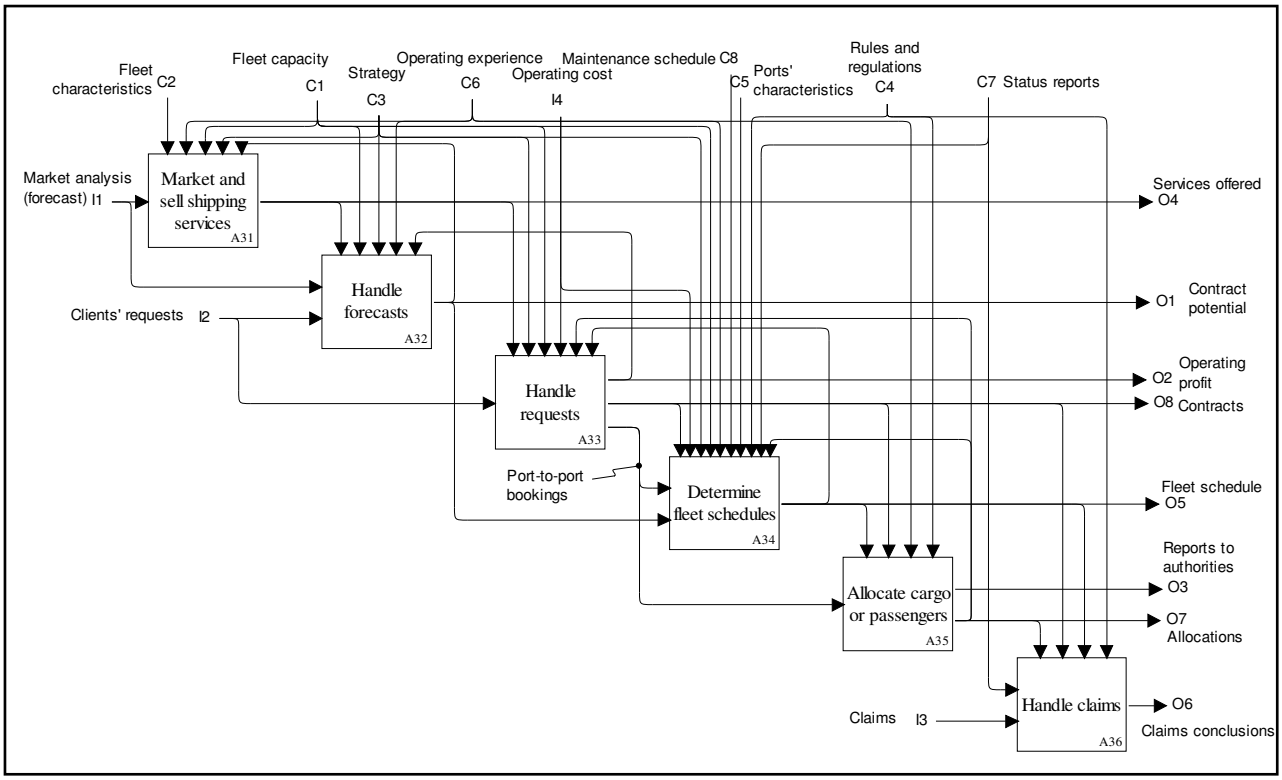


Figure 18 Manage commercial operations

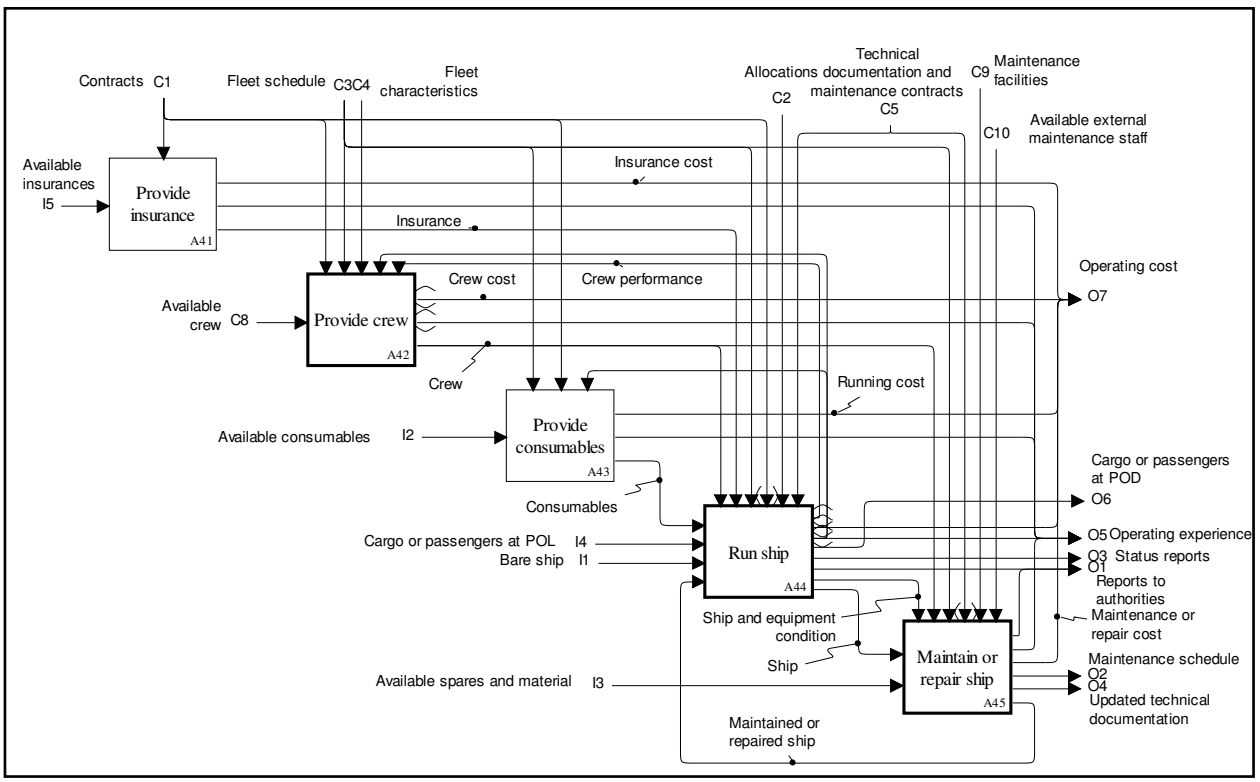


Figure 19 Operate ships sustainably

7.7 Options for the future

The well established relationship between equipment suppliers and ship owners/operators is illustrated in Table 4.

Equipment supplier	Ship owner/operator
Sells equipment	Buys equipment (either directly or through yard)
Sells spare parts	Buys spare parts
Provides maintenance cost guarantees	Administers cost guarantees – from time to time
Writes generic recommendations for equipment management	Searches for best practice for maintenance or repair
Provides customer services and technical support when required	Carries out all engine operational and engineering activities

Table 14

In industries like offshore oil exploration and air transport, this type of relationship used to be the norm. However, these industries have experienced a development where the traditional client/provider relationship has been replaced by closer partnerships, as illustrated in Figure 20.

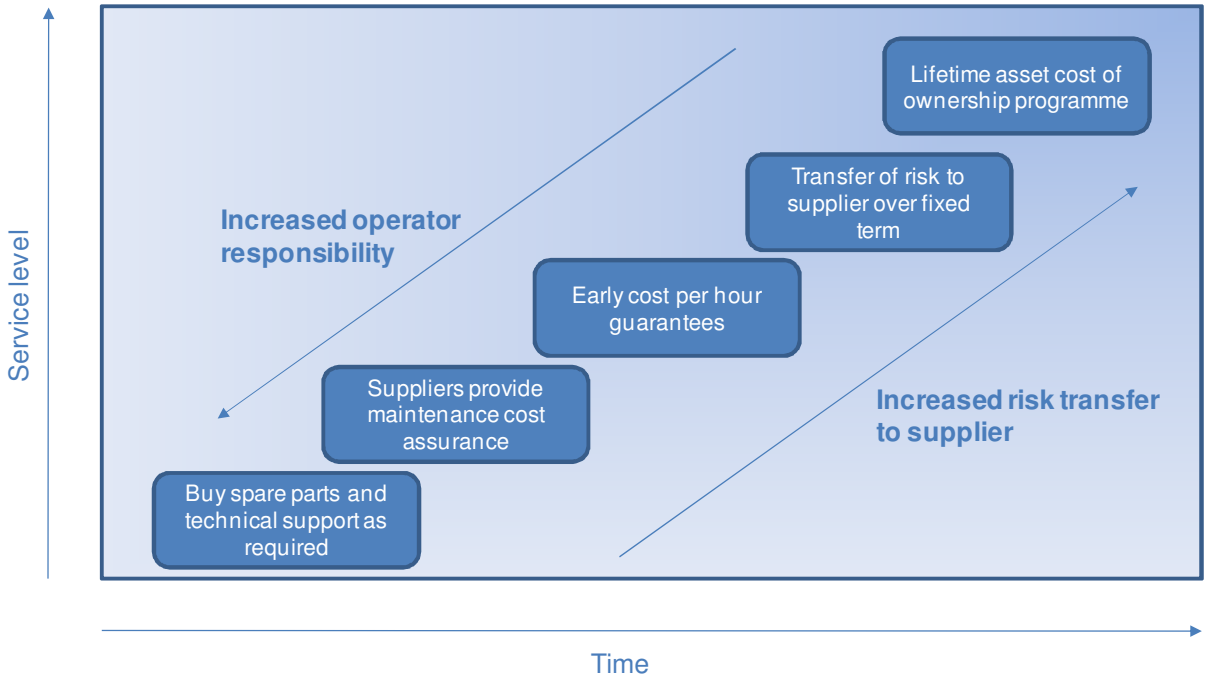


Figure 20 Transfer of responsibility (and risk) from operator to supplier

8. Summary

Sub-project A1 uses Operational Analysis techniques to identify the benefits of new 'Service Oriented' business models. These will enable cost effective management of ship operations, using new processes and technology, informed by best practice in aerospace and land transport.

The focus of sub-project A1 is to develop consistent technical operations strategies based on present technology within communication and real-time transmission of data, present crew composition and current demands for performance, cost-efficiency and sustainability. The sub-project develops the industry view of what can be achieved.

The overall structure of A1 comprises 4 activities:

- Understand the environment
- Define the "As Is" situation (in ship operations)
- Develop future scenarios
- Develop "To Be"

Sub-project A1 has five deliverables:

- D-A1.1 Requirements Capture Report
- D-A1.2 Define the 'As-Is'
- D-A1.3 Scenario Models
- D-A1.4.1 'To-Be' Process Models
- D-A1.4.2 Final Report (this document)

Each of the first four deliverables is summarised in this report.

D-A1.1 presents a high-level strategy of the businesses within cruise, ferry, container, tanker, and offshore shipping, with the subsequent step of establishing a formal method for measurement and management of business performance, realising that there is the need for developing a new way of measuring a ship's environmental performance, a ship's ecological footprint. This facilitates a quantitative analysis of the operational aspects of a business in order to identify areas of improvement, which will be covered in later tasks.

D-A1.2 presents the work in the following sequence:

- An overview of the generic business model.
- A description of the value mapping process and models.
- An assessment of the relative importance of the factors that affect safe, economic and efficient operation.
- An analysis of how operational data is collected manipulated and distributed, by whom the operational information is used, how it is used, and the costs of collecting, distributing and interpreting the information.

D-A1.3 predicts future business trends for the shipping industry, focusing specifically on cruise liners, ferries, oil tankers, and container ships using scenario based analysis. The process of developing the scenarios for each of the shipping industries involved brainstorming about influence factors and future scenarios, and identifying external drivers for change in each industry. Four macro scenarios were produced to identify two global factors and two extreme possible outcomes, for the future shipping sectors. By combining these two dimensions, four possible, fairly extreme scenarios for the future global development were constructed

D-A1.4.1 develops a generic "To-Be" business model for shipping operations. The model provides detailed presentation of running ships and maintaining or repairing them. It also provides a starting point in situations where shipping and equipment companies may discuss new approaches in ship operation and management, where the equipment suppliers may be taking a greater responsibility for ensuring the availability of the capabilities provided by the equipment in question.

To illustrate how the model may be adapted to different types of operations and, hence, shipping companies, this deliverable shows how selected elements of the model may be adapted to cruise and intra-European container shipping. It also discusses the possibilities of introducing new relationships between ship operator and equipment suppliers and/or shipyards, where functions for maintenance, repair or availability of equipment may be outsourced more than is currently normal.

D-A1.4.2 (this document) summarises all these deliverables and provides a final report for Sub-project A1.