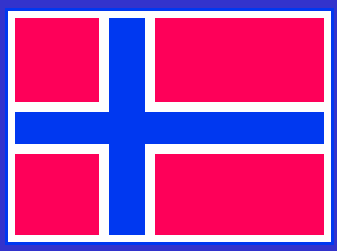
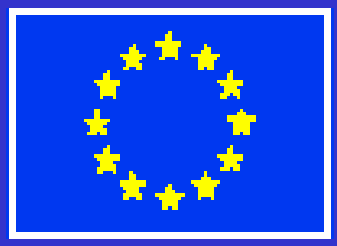
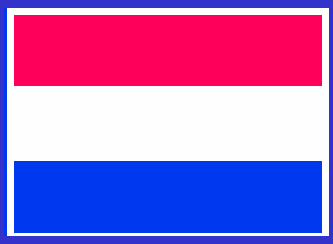
EUROPEAN MARITIME CLUSTERS

GLOBAL TRENDS • THEORETICAL FRAMEWEORK
THE CASES OF NORWAY AND THE NETHERLANDS • POLICY RECOMMENDATION

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In co-operation with

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European Maritime Clusters

Global Trends ■ Theoretical Framework
The Cases of Norway and the Netherlands ■ Policy Recommendations

Niko Wijnolst
Jan Inge Jenssen
Sigbjørn Sødal

November 2003

Dutch Maritime Network series[1]

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PREFACE

This is already the 25th publication in the Dutch Maritime Network Series, and the first one for which I have been asked to write a preface. This honour is bestowed on me as my chairman, Niko Wijnolst, is co-author of this book. Together with his colleagues Jan Inge Jensen and Sigbjørn Sødal a fine report on European maritime clusters has been produced that coincides well with the cluster discussions that presently take place in the European Union.

Europe has a great maritime tradition and today the maritime sectors play an important role in the economy, creating value and employment. The strength of the European maritime industry is based on the strength of the individual maritime sectors, but also on the synergies that exist within the entire maritime cluster. The studies undertaken in the Netherlands by the Dutch Maritime Network over the last six years, clearly have demonstrated the dynamics within the cluster and the important interaction between the demand and supply sectors. These findings are confirmed by the studies undertaken in Norway.

The gradual integration of European countries within a single market also affects the maritime sectors. It creates opportunities within Europe itself, like, for example, for short sea shipping, but it also creates export opportunities and opportunities for joint research and innovation. We believe that the forces that shape the Dutch and Norwegian maritime clusters and maintain their dynamics, are also at work on a European level. Therefore, we welcome the current study, jointly undertaken by researchers from these two leading maritime nations in Europe, which focuses on the enablers for strong and viable European maritime clusters.

The European Commission has been supportive of the maritime industries and we trust that the current study, its policy analysis and the methodological framework that it offers, can be useful to engage all sectors and countries in a European-wide debate. This should ultimately lead to stronger maritime clusters, based on intensive co-operation by the private sector and supported by forward-looking national governments. Much is to be gained for all, in a rapidly globalising economy, where many forces are at work that sometimes threaten the existence of European maritime sectors.

The study shows that the maritime clusters of Norway and the Netherlands are both viable, but that competitive positions change all the time. The formulation and implementation of a truly integrated European Maritime Cluster Policy could be instrumental in steering us clear of the dangers that are always encountered while sailing the high seas. We hope that this study will contribute to achieve that objective.

G.W. Bos
Vice-chairman, Dutch Maritime Network

SUMMARY

In this book the central question is: *What determines the dynamics of maritime clusters and their long-term viability, and how may policy measures contribute to the strengthening of the clusters?* The theory of clusters is put into perspective, on the basis of an understanding of the long-term development of the global shipping and shipbuilding sectors, as well as the insights derived from in-depth studies of two prominent maritime clusters in Europe: Norway and the Netherlands.

Ships carry the majority of commodities that are traded in international markets. For this reason, the development of the shipping industry is closely related to the development of the world economy. *Chapter 1* on *Shipping in the global economy* presents a broad picture of this relationship, starting with a discussion on the fundamental forces behind international trade and economic growth, and continuing with an empirical overview of the global economic development in the second half of the previous century. It is shown how growth in various shipping market segments follows long-term trends that are consistent with economic theory. The most characteristic feature is the rapid economic growth in Asia. It is argued that the ongoing growth process is likely to shift the point of gravity of shipping in the global economy, even further towards Asia, away from North America and Europe, in the years to come. This implies new opportunities for shipping in terms of growing markets, but it also implies a challenge in terms of how to expand and strengthen the existing maritime clusters in Europe.

Maritime clusters grow and may prosper for centuries, but this does not protect them from decline. This is illustrated in *Chapter 2*, *The Rise and Fall of Maritime Nations*, on the basis of the growth and decline of the shipbuilding and shipping sectors in the maritime nations of the world. Globalisation of the economy has resulted in fierce competition from new entrants, mostly in Asia, to the detriment of the traditional shipbuilding and shipping nations. In 2003 these global forces are still at work and this threatens today the very viability of the shipbuilding sector in Europe. Also, in shipping, traditional maritime countries have been surpassed by new entrants. The creation of a level playing field in Europe for the shipowners, has halted the further decline in market share. European shipowners now control under the European flags and other open registries, some 40 percent of the world fleet. Given the importance of shipping for seaborne and world trade, and consequently for European exports and imports, strong and viable shipping and shipbuilding sectors are essential for the future of the European economy. Understanding the forces that cause the rise and fall of maritime nations, and maritime clusters, may provide the clues on which new policies may be formulated to maintain clusters viable.

The structure and economic significance of the *European Maritime Clusters* cannot be easily determined on the basis of statistical sources in the individual countries, nor at the European level. Defining the cluster and its economic parameters in each country

is already a major task. Without this detailed insight it is difficult, if not impossible, to understand the dynamics of the maritime clusters and to assess their long-term viability. For this reason the European Commission commissioned a study in order to establish a basic insight into the size and structure of the European Union maritime cluster, including Norway. The results of this study, which are summarised in *Chapter 3*, confirm that the European maritime cluster is large and that its value creation is substantial. There are important differences among the individual countries, but considering the European perspective, the aggregate figures add up to a level which makes the cluster into a major contributor of the Gross European Product. These results provide the rationale for the European Commission to be actively involved in the policymaking of the European Maritime Clusters.

The relative strength of national industries has been the subject of study for many decades. The search of academics to find the *miracle cure* to enhance competitiveness of industries got a strong impetus from the work of Michael Porter, in particular *Competitive Advantage of Nations*, in 1990. Many other academics have contributed to the understanding of *Business clusters, Innovation and Value Creation*, as *Chapter 4* highlights. The theoretical basis of business clusters is an essential ingredient for the formulation of national and European policies which stimulate the dynamics and keep the clusters, in particular the maritime clusters, viable. The abundant research and insights that are available on clusters prove that cluster-based policies can work. However, it is not always easy to translate academic insights into real world policy measures. The reason for this is that the government has to adopt a cluster view as well, which requires an organisation and co-operation across several ministries. These vertically departmentalised institutions are sometimes difficult to align behind a common approach. Clustering at the governmental level should therefore be high on the agenda. The European Commission could stimulate such a change in attitude in the individual countries.

Measuring the cluster strength and comparing clusters of different make-up, is the subject of *Chapter 5*, *Benchmarking and Maritime Cluster Evaluation*. The benchmarking methodology has been developed for individual companies, but its application on entire sectors of industry, let alone on complete business clusters, is a recent application and development. Therefore, the theoretical basis has to be developed and this study intends to contribute to that academic objective. A benchmarking exercise starts with the definition of performance indicators and the measurement of these variables. *What are the performance indicators for maritime clusters?* The study discusses the existing methodologies and the problems associated with the application of the theoretical methodology to the real world. Several case-studies are presented, also from a EU perspective, as the European Commission has actively stimulated benchmarking projects in the maritime industry, such as in shipbuilding and marine equipment, but also on innovativeness.

The study identifies a number of performance indicators which are relevant for maritime clusters. These form the foundation for the definition of the *Enablers of Maritime Cluster Dynamics*, as presented in *Chapter 8*. Before this theoretical

framework is created, the maritime clusters of the Netherlands and Norway are discussed (*Chapters 6* and *Chapter 7*). These real world examples demonstrate the constraints posed upon a rigorous analysis, due to a lack of data, or to a conceptual difference in the definition of a cluster.

The Maritime Cluster of the Netherlands has been studied in great detail since the creation of the Dutch Maritime Network organisation in 1997. A summary of the many studies which have been published, highlights its economic structure and significance, as well as the policy agenda of the present and the future. The Dutch maritime cluster represents some 3 percent of GNP and 5.5 percent of the Dutch exports. The high export quote of more than 60 percent illustrates the international competitiveness and international orientation. The new shipping policy, which was introduced in 1996, has by now been copied by almost every European country and has significantly contributed to the revival of the European flag registration. The policy issues, which are collectively undertaken by the participating trade organisations of the Dutch Maritime Network, can be grouped under four themes: communication and image, education and labour market, export and internationalisation, and innovation and R&D. Over the period 1997-2002, the cluster grew with twenty percent, thus outperforming many industrial sectors in the Dutch economy. In order to maintain the dynamics and viability within the cluster, a level playing field is of the essence, in particular in the shipbuilding sector. The indirect value added by this sector is higher than the direct value added. This illustrates the important synergies between shipbuilding and the other maritime sectors. The agenda for the future lists a number of policy issues which are deemed necessary in order to participate in the globalisation process, while maintaining a healthy value creation in the Netherlands itself.

Chapter 7 describes *The Maritime Cluster of Norway* by examining several studies that have been conducted during the past 15-20 years. Representing about 7 percent of the value creation, the maritime cluster is an important part of the Norwegian economy. The introduction of the Norwegian International Ship Register (NIS) in 1987, which allows ship owners to employ foreigners with salaries agreed upon in their home countries, turned the trend of registering Norwegian-owned ships under flags of convenience. The maritime cluster has grown substantially the last 10 to 15 years. The highest estimation of the economic size of the maritime cluster is €25 billion in turnover and €6 billion in value creation.

The Norwegian maritime cluster is concentrated in seven different regions. The distances between the sub-clusters are considerable. Even though not all maritime sectors are represented in the Norwegian cluster, one of the key strengths of the cluster is regarded to be its completeness. The maritime industry in Norway includes a large number of equipment producers, maritime services, ship yards and shipping companies with the latter group of companies representing about 50 percent of the cluster. The maritime industry has created a varied and well-developed set of network organisations such as the Maritime Forum that was founded in 1990. Its aim is to strengthen co-operation between the different maritime sectors and lobbying Norwegian and international authorities on the behalf of the maritime industry. The

main challenge for the Norwegian industry is to maintain a high degree of competence within all maritime sectors and upheld the ability to innovate and create highly differentiated services.

Creating performance excellence is achieved with the help of the process enablers. The translation of maritime cluster performance indicators into cluster enablers is the subject of *Chapter 8*, *Enablers of Maritime Cluster Dynamics*. The various cluster performance indicators result in 7 maritime cluster enablers. These are: Define cluster, establish its economic significance and promote visibility; Define an industrial policy; Strengthen demand pull sectors; Monitor and maintain a level playing field; Promote exports and internationalisation; Strengthen innovation, R&D and leader firms; and Strengthen maritime education and labour market. For each country this may result in a different set of policy measures.

The term level playing field is sometimes used as a mercantilist argument for protection. In this context the intention is rather the opposite. The line of reasoning is mainly meant to reflect the total welfare gains that can be obtained within a country or a group of countries by removing subsidies and other distorting barriers to competition and trade as part of a holistic policy. It should not be seen as an argument for international harmonisation of factor prices. According to standard trade theory, gains from trade do not arise from equality but from differences in factor prices, or more generally, because countries are different. In essence, a country will normally gain from removing trade barriers, regardless of the policy of others, while the total gain is maximised when all subsidies are removed. Still trade negotiations in the World Trade Organisation and other international bodies seem for various reasons to be needed to promote free trade and ensure sufficient stability of international markets.

Towards a European Maritime Cluster Policy, is the subject of *Chapter 9*. The European Union has rapidly expanded its role and influence in economic policymaking. The various policy areas and how these relate to the maritime cluster are described. The next step has been to confront the 7 cluster enablers, as defined in *Chapter 8*, with the existing EU policies and suggest additional policy initiatives. These proposals should lead to an integral or holistic maritime policy, building upon the current strength and synergies between the various sectors and countries of Europe, of course including Norway and the new accession countries. The maritime industry should take the initiative for such European maritime cluster policy, as it will help business to adapt itself better to the rapid globalisation, withstand unfair competition, and capitalise on opportunities. The value creation by and contribution of the European maritime cluster to the welfare of Europe, now and in the future, will thus be safeguarded.

INTRODUCTION

What determines the strength and dynamics of industrial clusters, in particular the maritime clusters? is the central question of this study. If one understands the fundamental enablers of a strong cluster of maritime sectors, then companies, trade organisations, national governments and the European Union may devise strategies and policies to enhance the European maritime cluster as a whole and increase its long-term viability. On the basis of the maritime clusters of two countries, Norway and the Netherlands, a methodological framework for policy analysis is presented. This results in the formulation of seven maritime cluster enablers that are deemed crucial for policy making, in particular at the EU-level.

The nine chapters of this study are the following:

Chapter 1 – *Shipping in the Global Economy* discusses the forces that shape the global economy and the development of trade and shipping.

Chapter 2 – *The Rise and Fall of Maritime Nations* discusses in more detail the rise and fall of maritime nations since the World War II, in particular the changing fortunes in the shipbuilding and shipping sectors.

Chapter 3 – *European Maritime Clusters* summarises the results of the European Union study into the European maritime cluster and the implicit strategic issues that this study triggers.

Chapter 4 – *Business clusters, Innovation and Value Creation* discusses the theory of economic clusters and the relationship between clusters, innovation, productivity and wealth creation.

Chapter 5 – *Benchmarking and Maritime Cluster Evaluation* presents a methodology for defining the performance of maritime sectors and evaluation of maritime clusters.

Chapter 6 – *The Maritime Cluster of the Netherlands* describes the structure of the Dutch maritime cluster in economic terms and its development over the last five years.

Chapter 7 – *The Maritime Cluster of Norway* describes the structure of the Norwegian maritime cluster, excluding the offshore and fisheries sectors.

Chapter 8 – *Enablers of Maritime Cluster Dynamics* distils the enablers of cluster dynamics based on the existing theories of clusters in combination with the real world experiences in the Norwegian and Dutch clusters.

Chapter 9 – *Towards a European Maritime Cluster Policy* transposes the seven cluster enablers, as defined in Chapter 8, to a European Union policy level.

We hope that the analysis and concepts that are formulated in our study may contribute to a better understanding of maritime cluster dynamics, and that this, in turn, may result in a shared vision of the future and the policy measures necessary to make that vision come true. The book is a result of extensive cooperation across academic and geographical borderlines. Niko Wijnolst has drawn from a broad expertise in shipping, including maritime cluster dynamics and policy issues at the Dutch and European level. Jan Inge Jensen has contributed with specific knowledge in cluster theory, innovation and Norwegian maritime industries, while Sigbjørn Sødal is mainly responsible for the presentation of international economics and the development of global shipping markets.

We thank the sponsors of the study[2] and the publication[3] for their support.

Kristiansand, Rotterdam,

Jan Inge Jenssen, Niko Wijnolst
Sigbjørn Sødal

November 2003

[2] Agder Maritime Research Foundation, Norway
[3] Dutch Maritime Network Foundation

1. SHIPPING IN THE GLOBAL ECONOMY

1.1. Introduction

This book is about clustering or agglomeration of the maritime industry, which is but one example of localised production. Human activities of all sorts cluster, and seem to have done so at all times. Individuals, firms and industries are not spread evenly across the surface of the earth even when oceans, high mountains, arctic landscape and other natural barriers for human life are excluded.

Households and firms are the most visible signs of clustering at the micro level. Cities are the most visible sign at the macro level. At the turn of the previous century, 5 percent of the world population lived in cities with more than 100.000 citizens. At the turn of the millennium the share had increased to almost 50 percent [121]. More than half of all people now live at average densities exceeding 300 people per km^2, occupying less than 3 percent of the available land area [110]. Numerous studies conclude that the diversity associated with urbanisation is very important to economic growth and development [91].

Industrial agglomeration can be defined as the clustering of firms that are linked together via markets. This should be distinguished from clustering given by nature. Natural resources must obviously be harvested where they are located, so concentration of oil production in the North Sea is no example of clustering by this interpretation. In this study clustering is considered as a phenomenon that in some sense is determined by history and the evolution of markets. Only in that case will clustering be of significant interest from an economic welfare or economic policy perspective.

The market linkages could be horizontal, as firms within an industry produce similar articles, or vertical, as some (upstream) firms supply input factors or intermediate goods that are used by other (downstream) firms producing final goods or services. Regardless of what the exact linkages might be, industrial agglomeration can be seen as clustering at an intermediate level, between households and firms on the one hand, and complete societies like cities on the other hand. Economic theory and practice pay increasingly more attention to industrial agglomeration, because the economic forces behind clusters appear to be as strong and complex as they are important for economic growth and development.

This book deals with the characteristics and viability of maritime clusters in Europe with emphasis on two countries, the Netherlands and Norway. The objective of the current chapter is to discuss the global trade and shipping environment within which such maritime clusters grow, decline and possibly some day disappear.

International trade, economic growth, and political events and decisions are probably the three single most important external issues for any discussion of industrial

agglomeration in shipping. International trade is important, because the shipping industry carries the vast majority of interregional world merchandise trade. Such trade is a main driving force and indicator for the long-run development of the markets for shipping services.

Economic growth lays the foundation for change in consumption, trade patterns, market structures and industry production structure, including the development of maritime clusters. Population growth, technological improvements and productivity growth, all have great impact on shipping. New ship technology has led to large reductions in trade costs, establishing new trading opportunities and new production opportunities in shipping. When combined with aggregate productivity and income growth in many regions of the world, the effect has been very high growth rates of shipping demand over most of the 20th century. The fact that rapid economic growth is spreading to new regions, the emerging economies of East Asia in particular, continues to change the structure of the global economy and global shipping markets.

Political events and decisions may have even stronger impact in some cases. Security crises and wars have consistently supplied the world's shipping markets with unexpected demand and supply shocks. Environmental laws and regulations, taxation schemes and other political decisions in times of peace have played a less important role in the past, but may become more important in the future [68].

In order to understand how the shipping industry is affected by the economic forces just mentioned, the following section (1.2) describes the underlying economic theory that can explain the development of trade and shipping demand. Then the long-term trends in international trade markets are discussed (1.3-1.4), followed by a discussion on the implications of this development for the shipping markets (1.5-1.6). The discussion on political aspects is restricted to some brief comments on two issues, international security and environmental concerns (1.7). Finally, the main results are summarised (1.8).

1.2. Trade and growth theory

Economic theory gives two main explanations why gains from international trade arise: *comparative advantage* and *scale economies* [90][56]. According to comparative advantage theory, originating from the classical work of Ricardo [98], a country will gain from exporting goods and services, for which it has a comparative advantage. The country will import goods and services for which it has a comparative disadvantage. By definition, that will be goods and services for which some other country has a comparative advantage. Export could be direct, in terms of an abundant resource such as the Dutch natural gas from Groningen, or indirect as an abundant resource is embodied in an intermediate good or a consumer good, e.g. when Norway exports aluminium. The production process uses bauxite (imported from Brazil or another country with comparative advantage in production of bauxite), combined with cheap hydropower extracted from rainy Norwegian mountains.

In one way or another, trade driven by classical comparative advantage is about exchange of abundant production factors or resources, i.e., skilled and unskilled labour, capital, and natural resources of various kinds. The most characteristic feature of such trade is that rich countries, which are endowed with much capital relative to labour, will export capital-intensive goods and services, and import labour-intensive goods and services. As long as the production factors are paid according to how scarce they are, the price of an abundant resource will be low. Trade theory predicts that increasing trading opportunities cause the factor price differences between countries to decrease. The empirical evidence suggests that this effect is moderate. Significant factor price differences will remain even in a world with open markets and extensive trade.

Comparative advantage explains most of the world's trade in terms of volume, including bulk trades like oil, oil products, iron ore and grain. Many such commodities are necessity goods, or inputs to production of necessity goods with low income elasticities in advanced economies. Then, demand does not increase as fast as income. Unless anything else changes at the same time, nor will demand for shipping services increase at the rate of income.

Comparative advantage theory cannot explain all trade, especially not trade in all kinds of manufactured goods. A famous study by Grubel and Lloyd [29] revealed that more than 50 percent of world trade in value terms was *intra-industry,* two-way trade.[4] There is extensive trade of this kind in the automobile industry and similar industries. France exports Citroens to Germany, while at the same time Germany exports BMWs to France. Such trade requires new explanations, since two-way trade will not result from comparative advantage. It is hard to see why the endowment of natural and human resources in France and Germany should result in this exchange. Since both countries have the technology and other resources needed to manufacture modern automobiles, why not simply make their own, and save the trade costs?

The most common explanation for intra-industry trade is *scale economies* combined with consumer preferences for variation. Consumers are different, and both individuals and the market as a whole, prefer variation. When a production technology is characterised by scale economies (originating from some fixed cost element), the number of varieties that can be achieved in any economy of finite size, will be limited. This is the case for the car industry. Neither Germany nor France may have a specific advantage in producing cars, but the size of each market represents a barrier to production of a large number of brands. Intra-industry trade increases the effective size of the market and leaves the consumers with more freedom to choose between similar, but not identical products. To a large extent, it becomes a matter of incident, history or minor cultural differences what exact varieties are manufactured in each country.

[4] The extent of intra-industry trade can be measured by a Grubel-Lloyd index. The index ranges from 0 to 100, and is given by $I=100\cdot[(X_i+M_i)-|X_i- M_i|]/(X_i+M_i)$, where X_i is total export and M_i is total import for the industry.

Trade in differentiated goods, like the ones mentioned, also enables more efficient production and lower prices, because production expands and competition increases. Intra-industry trade is often associated with trade in manufactured goods, but this obviously depends on how an industry is defined. Regardless of definition, normally intra-industry trade is trade in specific goods that require significant set-up costs like R&D, a costly and large production line, or branding. Such goods are usually not necessity goods to the same extent as basic food and housing services. Then, demand is typically income-elastic in a rich economy, and the value of intra-industry trade will increase at a higher rate than that of many other trades. As far as shipping is concerned, much intra-industry trade consists of products with high value-to-weight ratios that are transported on container ships, car carriers or alike.

Economic theory and empirical studies suggest a large number of economic growth forces [7][47]. Among the most important ones, are incentives leading to high investment and priority to education, openness to competition and international trade, industrialisation and urbanisation, well-defined property rights, even income distributions and robust economic institutions.

Two main strands of growth theory exist side by side: *neoclassical growth theory* in the tradition of Solow [111], and *new growth theory* in the tradition of Romer [101]. Investment and accumulation of capital are crucial for increasing economic growth in both cases. Neoclassical theory predicts that increased investment or capital accumulation can only spur economic growth temporarily. No such limit exists for new growth theory. The main reason for the difference is found in the understanding of capital. Neoclassical theory hinges on perfect competitive markets with decreasing returns to investment, which makes sense because capital is usually thought of as real assets. New growth theory focuses on accumulation of human capital and knowledge, in imperfect markets with knowledge spillovers and other externalities.

The two growth models imply enormous potential differences in terms of growth and trade patterns. Neoclassical theory predicts that free trade will even out differences in income and growth performance. In the long run, productivity growth will follow a fundamental natural growth rate, which is often estimated to 1.5-2 percent per year. New growth theory predicts that large countries or countries that invest more than others could sustain higher productivity growth. As far as shipping is concerned, this means, for example, that the rapid growth characterising many East Asian countries over the last half of the 20th century need not be a temporary phenomenon. (According to new growth theory the Asian growth miracle is sometimes thought to be inconsistent with neoclassical theory, but that is not correct according to Young [132]).

To some extent it may be said that the two strands of economic growth theory have parallels in global trade and shipping markets. Growth of production and trade in raw materials and other commodities usually traded in competitive markets, has been stable at 1-2 percent per year for decades. Growth of trade in differentiated manufactured goods, where the markets are less perfect, has been much higher. The most visible sign of this development is the growth rate of container trades.

Economic growth and increasing intra-industry trade are driven partly by quantity changes, and partly by quality changes. The latter implies increasing value to weight ratios in shipping. Growth of demand for shipment can be expected to increase at a higher rate than income, but not to the same extent as growth in intra-industry trade. More generally, the characteristics of trade based on comparative advantage versus trade based on product differentiation and economies of scale will be seen to have had great impact on the development of the shipping markets.

The new theories on growth and trade, based on imperfect competition and externalities, have more recently developed into formal economic theory of firm location and clustering (See [54] for a seminal paper, and [26] for a survey). Cluster theory is discussed from various perspectives in Chapter 4, and will not be addressed further here.

1.3. Global production and trade patterns

The 20th century has been characterised by rapid growth of production and trade. This includes natural resources and intermediate goods as well as consumer goods and services of many kinds. For the shipping industry, values and volumes of merchandise trade (which excludes construction and services) are a good indicator of the development. Some key figures are shown in *Table 1*.

Growth of trade has been much higher than growth of production over the last 50 years. Global production increased by 3.8 percent per year. The volume of merchandise exports increased by 6.4 percent per year, and the value by 9.7 percent. Such large growth differences sum up to drastic changes for the level of production and trade at the end of the period.

The total value of world production is 6-7 times as large now as in 1950. The value of merchandise trade is 100 times as large, while the value of trade in manufactures is more than 200 times as large. Even if the numbers are distorted by inflation and quality changes the net result is clear. Growth in international trade has been enormous, and much higher than growth of production and income. This is visualised in *Figure 1*, showing the explicit correlation between growth of production and growth of merchandise trade for the last 15 years.

The trend line indicates that three percent growth in world GDP, roughly implies nine percent growth in merchandise trade, but there are large variations from year to year. The impact on the shipping markets follows suit, as will be clear below. The growth rate of production has slowed down after the *golden age* of the 1950s and 1960s. Growth of trade has not slowed down to the same extent, and the trend towards globalisation in the sense of a more integrated world economy appears to strengthen.

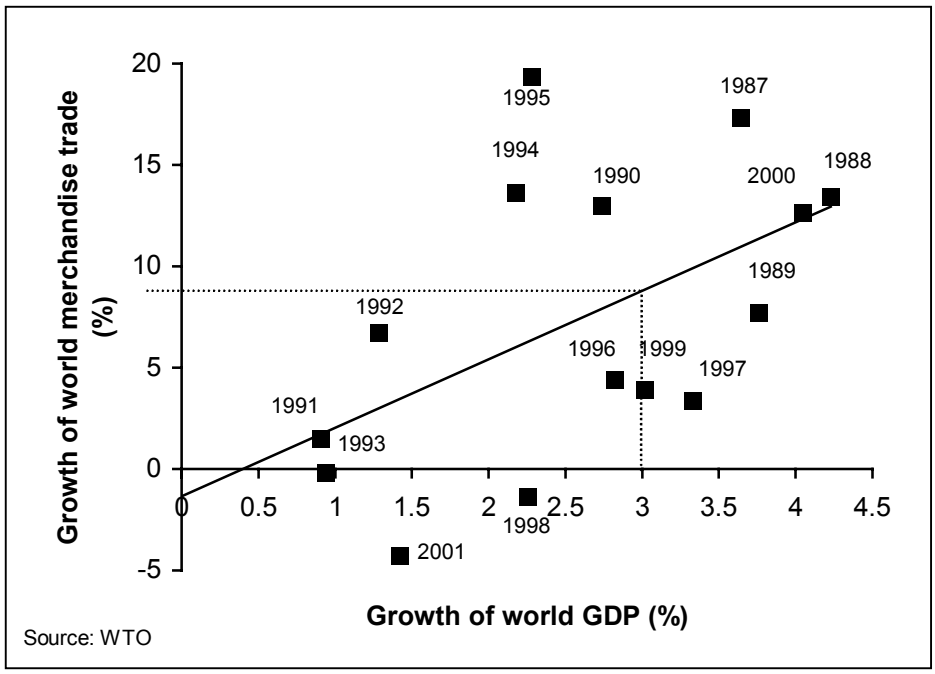

Figure 1: Correlation between growth of GDP and growth of merchandise trade

Index (1950=1.00)	1950	1960	1970	1980	1990	2000
Value of exports	**1.00**	**2.11**	**5.11**	**32.66**	**55.30**	**101.06**
Agriculture	1.00	1.43	2.29	10.65	14.95	19.72
Mining products	1.00	2.33	5.67	63.19	54.74	97.30
Manufactures	1.00	2/78	8.26	47.61	105.74	204.93
Volume of exports	**1.00**	**2.10**	**4.76**	**7.96**	**11.69**	**21.78**
Agriculture	1.00	1.62	2.38	3.36	3.90	5.74
Mining products	1.00	2.17	4.35	5.13	5.64	8.14
Manufactures	1.00	2.31	6.25	12.44	21.43	42.53
Volume of production	**1.00**	**1.65**	**2.94**	**4.26**	**5.44**	**6.91**
Agriculture	1.00	1.34	1.20	2.14	2.73	3.35
Mining products	1.00	1.55	2.63	3.45	3.48	4.04
Manufactures	1.00	1.88	3.85	5.85	7.84	10.24
GDP	1.00	1.55	2.63	3.82	5.24	6.58

Annual growth (%)	1950-1960	1960-1970	1970-1980	1980-190	1990-2000	1950-2000
Value of exports	**7.8**	**9.2**	**20.4**	**5.4**	**6.2**	**9.7**
Agriculture	3.6	4.8	16.6	3.4	2.8	6.1
Mining products	8.8	9.3	27.3	-1.4	5.90	9.6
Manufactures	10.8	11.5	19.1	8.3	6.9	11.2
Volume of exports	**7.7**	**8.6**	**5.3**	**3.90**	**6.4**	**6.4**
Agriculture	4.9	3.9	3.5	1.5	3.9	3.6
Mining products	8.1	7.2	1.7	1.0	3.7	4.3
Manufactures	7.7	10.5	7.1	5.6	7.1	7.8
Volume of production	**5.1**	**6.0**	**3.8**	**2.5**	**2.4**	**3.9**
Agriculture	3.0	2.5	2.2	2.5	2.0	2.4
Mining products	4.5	5.4	2.7	0.10	1.50	2.80
Manufactures	6.5	7.4	4.3	3.0	2.7	4.8
GDP	**4.5**	**5.4**	**3.8**	**3.2**	**2.3**	**3.8**

Table 1: World merchandise export in selected periods [130]

Growth of trade in agricultural products is significantly lower than that of mining products and manufactures. This result fits with the notion from the previous section of agriculture as consisting of many necessity goods for which demand does not increase at the rate of income. Manufactures represent the other extreme, embodying many luxury goods for which demand increases faster than income. Even during the 1990s, when the large Japanese economy was constantly in stagnation, and a severe economic crisis in 1997-98 hit many other Asian economies, world trade in manufactures kept growing at an astonishing pace.

1.4. Distribution of production, growth and trade

The world economy is dominated by a small number of countries in terms of production and trade. This can be seen from *Table 2*, containing some key economic data for the 20 countries with highest GDP in the world.

Country (%-points)	Share of global GDP	GDP per capita relative to USA (index)	Share of world population	GDP annual growth 1965-1999	Population annual growth 1965-1999	Export value annual growth 1965-1999	GDP annual growth 1980-1990	GDP annual growth 1990-1999
USA	22.1	100	4.8	3.4	1.1	6.5	3.6	3.3
China	11.5	11	22.1	10.4	1.7	11.2	10.1	10.7
Japan	7.8	78	2.2	2.6	0.7	7.3	4.0	1.3
India	5.5	7	18.0	5.9	2.1	7.3	5.8	6.0
Germany	4.7	72	1.4	1.7	0.2	-	2.2	1.3
France	3.3	70	1.0	1.9	0.5	5.8	2.4	1.5
UK	3.2	69	1.0	2.8	0.3	4.3	3.2	2.5
Italy	3.1	69	1.0	1.9	0.3	5.5	2.4	1.4
Brazil	3.0	22	3.0	2.8	2.0	8.2	2.7	3.0
Russia	2.8	25	2.5	-	0.4	-	-	-6.1
Mexico	2.0	25	1.8	1.9	2.4	10.0	1.1	2.7
Canada	2.0	78	0.6	3.0	1.3	6.0	3.3	2.7
South Korea	1.9	50	0.8	7.5	1.5	15.6	9.4	5.7
Spain	1.8	56	0.7	2.6	0.6	7.3	3.0	2.2
Indonesia	1.5	8	4.0	5.4	2.0	5.6	6.1	4.7
Australia	1.1	74	0.3	3.8	1.5	5.8	3.5	4.1
Argentina	1.1	35	0.7	2.1	1.5	5.3	-0.7	4.9
Turkey	1.0	20	1.2	4.6	2.2	-	5.4	3.8
Netherlands	0.9	74	0.3	2.5	0.7	5.0	2.3	2.7
South Africa	0.9	27	0.8	1.4	2.2	1.8	1.0	1.9

Table 2: Global economic data 2001 [131]

The countries dominating the world economy fall in two distinct groups: Japan plus the rich welfare states in North America and Europe, and the world's two most populous, but stil relatively poor countries, China and India. Together with South Korea, the two latter have seen the highest growth rate of output of all 20 countries. They represent by far the most potent sources of future growth for the world economy as a whole.

From *Table 2* one is also tempted to deduce that the countries with the lower initial level of production (1965 or earlier) are also the ones that have grown the most. This seems to support the hypothesis of neoclassical growth theory that income levels in different countries will converge in the long run. Several empirical studies support this view, but one should be aware that there is an implicit tendency with data like these of listing economic success stories. Countries that started out poor and for which a growth process has not taken off are absent from the list. The slightly modified conclusion from several growth studies is that neoclassical income convergence does seem to occur, but only for countries that initially are sufficiently similar. Some emerging Asian economies that started out poor, have succeeded in joining the club of industrialised trading partners for which income convergence applies. Many other poor countries have been less successful.

Income convergence effects explain to some extent why Japan and Europe over the last 10-20 years have not outperformed the United States, relative to preceding decades, when the income gap between these regions was reduced. The average income level in a country like South Korea is not far behind most of Europe in the 1950s and 1960s, when measured relative to the United States, whereas China, India and Indonesia are far behind. The main implication for future trade and shipping patterns of the arguments above, may, therefore, be that economic growth theory does not predict that economic growth in the emerging Asian economies will slow down in the foreseeable future. If growth slows down it will probably stem from political events that prevent the markets from functioning properly rather than from fundamental economic factors of international markets.

Demography is an additional reason why the emerging economies of East Asia should be seen as the most favourable growth region of production and trade. Population growth has been higher, and the current labour force is accordingly younger than in Europe. Population growth can be expected to decline as a result of economic growth, but except from Japan, where the labour force is ageing as in Europe, most Asian economies will not soon face similar demographic challenges.

Table 2 represents more than 80 percent of the world's GDP and 68 percent of the population. As far as the regional distribution is concerned, which is of greater interest to international shipping markets than single countries, approximately 75 of the world economy originates from three regions that are almost equal-sized in terms of total output:

- Western Europe (EU and other European welfare states);
- North America (United States, Canada and Mexico);
- East and South East Asia (mainly Japan, China, India, South Korea and Indonesia).

The regional distribution of productivity and growth shows up in the regional trade patterns. This is clear from *Table 3*, where the shares of inter-regional trades between the various economic regions of the world is listed.

Origin\Destination	North America	Latin America	Western Europe	C.E. Europe	Africa	Middle East	Asia	World
North America	**6.5**	2.7	**3.1**	0.1	0.2	0.4	**3.5**	16.6
Latin America	**3.5**	1.0	0.7	0.1	0.1	0.1	0.4	5.8
Western Europe	**4.3**	1.0	**28.0**	2.5	1.1	1.1	**3.3**	41.5
C./E. Europe/Baltic States/CIS	0.2	0.1	2.6	1.3	0.1	0.1	0.3	4.8
Africa	0.4	0.1	1.2	0.0	0.2	0.1	0.4	2.4
Middle East	0.7	0.1	0.7	0.0	0.2	0.3	1.9	4.0
Asia	**6.3**	0.7	**4.2**	0.3	0.4	0.8	**12.1**	25.0
World	21.9	5.6	40.6	4.2	2.1	2.7	21.7	100.0

Table 3: Interregional and intraregional trade value, percentage shares [131]

The shaded cells in *Table 3* represent trade flows whose share exceeds three percent of the value of global trade. Intra-regional trade in Europe and Asia accounts for very large portions of all trade, as there is a large number of countries in these regions compared with North America. (European trade of this kind would be reduced drastically by treating EU as one trading unit.) Interregional trade is dominated by the trade routes between the three main economic regions. Trade between Latin America and North America is the only other route of significant interest. Trade between Asia and North America is by far the most important interregional trade route in the world. The numbers in *Table 3* are based on value shares, which are dominated by trade in manufactured goods. As far as the international shipping industry is concerned, this is more relevant to the trades in manufactures and other commodities with high value-to-weight ratios.

The are several similarities, but also major differences between trade markets and shipping markets, even if most international trade hinges on seaborne transport. Interregional trade is a main demand driver for shipping in the long run. The relationship is more complex in a short time perspective. Increasing trading opportunities can affect the intensity of competition, and thereby the shipping market structure in various segments. The cost of maritime shipping services, is itself an explaining factor why international trade has grown so rapidly. Increasing trading opportunities, also, influence the industry structure of shipping via choices of production factors, location of activities and clustering.

1.5. Shipping implications of trade and growth

The previous sections pointed at a long-term positive relationship between total growth of global output, trade and shipping demand. While *Table 2* showed the connection between economic growth and trade growth, *Figure 2* illustrates the correlation between economic growth and growth of total production in shipping, measured in tonne-miles.

Despite the fact that most international trade is carried by ships, trade markets and shipping markets are not always positively correlated. This can be seen from *Figure 1* and *Figure 2*. Worldwide economic growth slowed down in 1993, along with

merchandise trade, but there was an increase in shipping demand. There are several reasons for such effects.

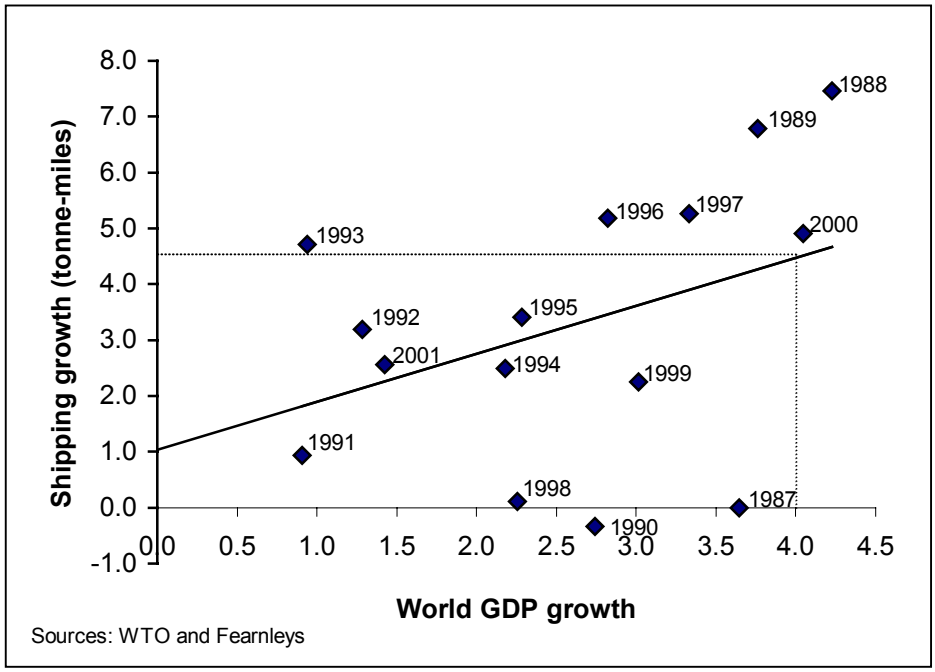

Figure 2: Correlation between growth of GDP and growth of shipping demand

First of all, trade markets are usually described in value terms, while shipping markets are described more conveniently in terms of volumes. A certain growth rate of production usually translates into growth of trade, but not always into growth of seaborne trade. Second, income growth does not imply the same increase of demand of all goods, as already pointed out. Third, geography plays a major role for the evolution of shipping demand. The distances between the main economic regions are different, and the average length of haul is not fixed in market segments that are subject to change. This affects the supply side, since the volume of trade that can be handled by one ship for a certain period of time, depends crucially on the travel distance.

The shipping markets are dominated by a small number of energy goods and raw materials with low value-to-weight ratios. The demand for shipment of such goods will be correlated with the global development of production and trade only to the extent that the distribution of production and consumption remains constant between the main trading regions. At the time of writing, the dry bulk market is booming, mainly due to extreme growth of demand for iron ore from the steel industry in China. This happens at the same time as most of the main economic powers in the world economy are stagnating.

For all of the reasons mentioned above, the relationship between trade, growth and shipping markets needs to be investigated separately for various shipping segments. A complete analysis of this kind would be too extensive, so the discussion below will just point at some main characteristics. *Table 4* shows the development of the main shipping segments after 1986.

	Bulk								Oil		Gas		
Year	Iron Ore	Coal	Grain	Bauxite Alum.	Phos. Rock	Minor Bulk	Cont.	Other Dry	Crude	Products	LPG	LNG	Total
1986	311	275	187	42	45	555	173	555	1030	401	22	35	3631
1987	319	293	211	46	45	575	192	532	977	379	24	37	3631
1988	346	313	216	49	47	603	211	550	1086	417	23	41	3902
1989	362	314	220	55	44	614	231	578	1198	480	26	44	4167
1990	347	327	215	55	37	607	246	626	1155	448	28	53	4153
1991	358	360	218	53	31	606	268	652	1161	403	30	52	4192
1992	337	368	224	48	30	618	292	673	1245	407	32	53	4326
1993	352	372	223	51	27	626	322	687	1354	438	34	55	4530
1994	380	374	207	49	29	659	357	689	1375	432	33	58	4643
1995	402	402	216	52	30	699	389	696	1400	448	34	33	4801
1996	392	425	219	54	31	698	430	753	1469	477	36	66	5050
1997	428	450	229	55	32	707	470	789	1550	496	37	74	5316
1998	428	451	226	55	31	686	503	810	1544	478	35	75	5322
1999	405	464	247	54	31	683	559	799	1578	504	37	82	5442
2000	449	506	264	54	28	697	622	806	1655	498	39	92	5709
2001	454	535	260	54	27	698	630	861	1656	548	36	94	5855
2002	474	547	268	54	26	705	669	854	1608	560	36	100	5901
Share '86 (%)	8.6	7.6	5.2	1.2	1.2	15.3	4.8	15.3	28.4	11.0	0.6	1.0	100.0
Share '02 (%)	8.0	9.2	4.5	0.9	0.4	11.9	11.3	14.5	27.2	9.5	0.6	1.7	100.0
Annual growth 1986-2002	2.7	4.4	2.3	1.6	-3.4	1.5	8.8	2.7	2.8	2.1	3.1	6.8	3.1

Source: Clarksons

Table 4: Main shipping segments, million tonnes

Total seaborne trade in terms of volume increased by 3.1 percent per year between 1986 and 2002. This is less than the growth rate of trade in value terms. Oil and oil products retained a dominating position in terms of volume despite lower growth rates than the average.

Empirical studies show that worldwide consumption of energy in the long run increases at a lower rate than GDP. From *Table 1*, one can deduce that worldwide GDP increased by an average of 3.1 percent per year between 1971 and 2000, or the same rate as seaborne trade measured in tonnes. According to IEA [34], worldwide primary energy demand increased less, by 2.1 percent per year. The energy intensity in terms of energy use per unit of GDP on a purchasing power basis decreased by 1.1 percent per year over the same period. Thus, the decline in shipments of energy commodities relative to other seaborne trade is part of a long-term global economic development. This is consistent with the theoretical arguments spelled out earlier. The growth rates of container trades that can be observed from *Table 4* are spectacular, and fit equally well with the economic theory. Even in volume terms, container trades now outperform all other specific market segments except for crude oil.

A rough indicator for the development of the content of seaborne trade is depicted in *Figure 3*. The figure plots the value of global merchandise exports relative to the total volume of seaborne trade over the period 1986-2001. This ratio dropped significantly in 2001 as a result of the worldwide recession, but the long-term trend is clearly upward. The value content of seaborne trade increased by 70-80 percent, or close to

four percent per year. Growth of trade in manufactured goods, most of which is carried by container ships, is obviously a main driving factor for this development.

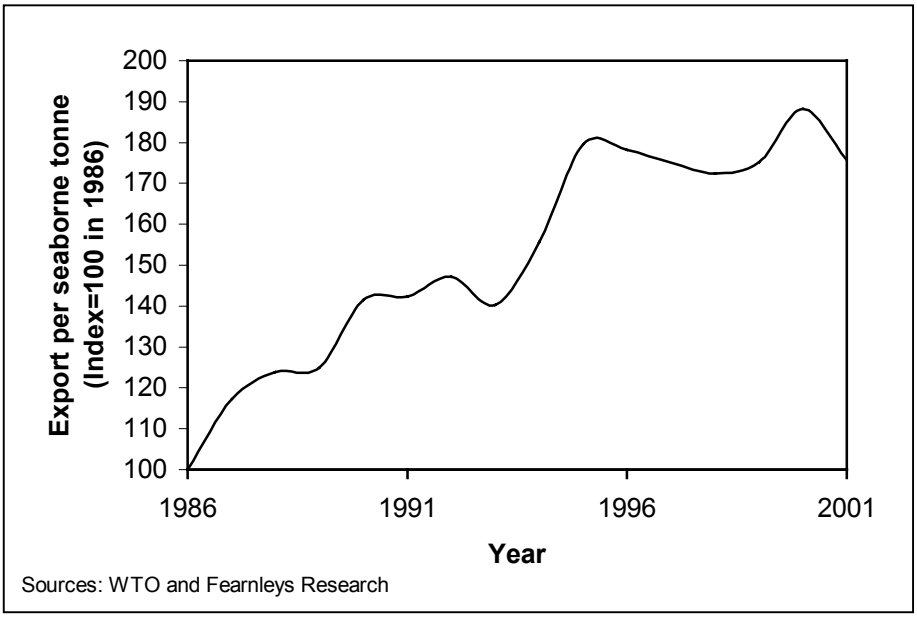

Figure 3: Value-to-weight indicator of seaborne trade

The regional distribution of seaborne trade may be of more interest than total numbers. *Table 5* shows some key figures for the development of regional imports of crude oil.

	1970		1980		1990		2001		Annual growth 1990-2001 (%)
	Volume (million tonnes)	%	Volume (million tonnes)	%	Volume (million tonnes)	%	Volume (million tonnes)	%	
North America	73.4	6.7	274.3	17.9	274.9	20.9	457.8	27.3	4.7
Western Europe	621	56.4	585.5	38.3	446.8	34.0	426.8	25.5	-0.4
Japan	170.4	15.5	216.3	14.1	201.2	15.3	215	12.8	0.6
S. and S.E. Asia	54.8	5.0	106	6.9	166	12.6	313.9	18.7	6.0
Others	181.4	16.5	347.9	22.7	226.1	17.2	261.4	15.6	1.3
Total	**1101**	**100.0**	**1530**	**100.0**	**1315**	**100.0**	**1674.9**	**100.0**	**2.2**

Source: Review of maritime transport 2002, Annex II.

Table 5: Regional distribution of crude oil imports in selected years

Imports to North America increased significantly in the 1990s, partly due to a booming economy. Imports to Western Europe declined both in absolute and relative terms. The latter was made possible mainly by increased oil production in the North Sea. Imports to Japan stayed almost fixed in absolute terms, but decreased in relative terms over the last decade due to economic stagnation. All these changes are minor compared to the rest of East and South East Asia, including China and India. Imports here almost doubled during the 1990's. According to [34] it does not stop here. *Table 6* shows a regional outlook for oil supply, demand and regional oil movements in 2010 compared with data from 2000.

Oil imports and exports (barrels per day)	2000				2010				
	Demand	Supply	Import	%	Demand	Supply	Import	%	Growth 2000-2010 (%)
North America	22.2	13.6	8.6	30	24.8	14	10.8	26	26
Western Europe	14.1	6.7	7.4	26	15.3	5.2	10.1	24	36
Japan/Australia/New Zealand	8.5	0.9	7.6	27	9.5	0.5	9.0	21	18
Russia & E.E. transition economies	4.6	8.1	-3.5	12	5.4	12.7	-7.3	19	109
China	4.9	3.2	1.7	6	7.0	2.8	4.2	10	147
India	2.1	0.7	1.4	5	3.0	0.5	2.5	6	79
Other emerging Asian economies	4.8	3.0	1.8	6	6.7	1.4	5.3	13	194
Latin America	4.5	6.0	-1.5	5	5.8	7.3	-1.5	4	0
Africa	2.0	6.9	-4.9	17	2.9	9.6	-6.7	17	37
Middle East	4.1	23.1	-19.0	66	5.2	28.3	-23.1	60	22
Total (including processing gains & non-conventional oil)	75.0	75.0			88.8	88.8			18

Table 6: Regional oil imports in 2000 and 2010 [34]

Global oil production and consumption is expected to increase with 18% between 2000 and 2010, but there are large regional differences. China, India and other emerging Asian economies with low production of oil get more dependent on oil imports. These Asian countries stood for 17 percent of regional oil imports in 2000. The similar share in 2010 is expected to be 29 percent of a global oil market, which will be 18 percent larger than in 2000.

The rightmost column in *Table 6* shows that Chinese oil imports will increase by almost 150 percent, and imports to some other Asian countries by even more. When including Japan, it follows that almost half of all interregional oil trades will soon be imports to Asia. The import shares of the core economic regions in North America and Europe will decline. Considering that some interregional trade is transported by pipelines (including production from Russia), the implications for tanker trades are evident. Eastbound supertankers starting out in the Middle East will dominate the oil tanker markets more and more.

Interregional container trades are totally dominated by the three main routes between Asia, Europe and North America. The market shares have been relatively stable. The total market share of trades (both ways) between Asia and North America is close to 1/2; the similar share is 1/3 between Asia and Europe, and 1/6 between North America and Europe.

The dominance of Asia in container transport is the most visible in port operations. Out of the world's ten largest container ports, are all of the top five situated in East and South East Asia. Three ports among the rest are European; the two remaining ones are American. This can be seen from *Table 7*, which lists the annual throughputs in TEU terms for all of these ports between 1995 and 2001.

Throughputs (Million TEU)	1995	1996	1997	1998	1999	2000	2001	Annual growth 1995-2001
Hong Kong	12.55	13.46	14.54	14.65	16.21	18.10	17.80	6.0 %
Singapore	11.83	12.95	14.14	15.10	15.94	17.04	15.57	4.7 %
Busan	4.50	4.73	5.23	5.73	6.44	7.54	8.07	10.2 %
Kaohsiung	5.05	5.06	5.69	6.27	6.99	7.43	7.54	6.9 %
Shanghai	1.53	1.93	2.53	3.05	4.22	5.61	6.33	26.8 %
Rotterdam	4.79	4.94	5.45	6.03	6.34	6.28	6.10	4.1 %
Los Angeles	2.56	2.68	2.96	3.38	3.83	4.88	5.18	12.5 %
Hamburg	2.89	3.05	3.34	3.57	3.74	4.25	4.69	8.4 %
Long Beach	2.84	3.07	3.50	4.10	4.41	4.60	4.46	7.8 %
Antwerp	2.33	2.65	2.97	3.28	3.61	4.08	4.22	10.4 %

Source: Clarksons

Table 7: Port operations for the world's ten largest container ports

1.6. Shipping structure implications of trade and growth

The intensity and types of competition differ between various market segments in shipping [114][126]. Trade increases the size of markets, and typically increases the intensity of competition, although the opposite may also happen in rare cases. The exact consequences depend on technological characteristics and the initial market situation.

International bulk shipping markets have for a long time been considered to be among the world's most competitive markets. Increasing demand for such trades probably has minor impact on the intensity of competition. There has been no clear development over the last twenty years towards increased market concentration in terms of larger ships, companies or alliances. The situation is different for container trades, which has been characterised by increasing ship sizes and more dominant large market players. The size of the largest container ships has almost tripled since 1980, and mergers have contributed to increased market shares for the largest liners.

The future is less certain as container trade is a complex business, with sea transport that needs to be integrated within larger logistics networks. The final extent of the ongoing consolidation process remains to be seen. The future most likely will bring even larger container ships and combined with hub and feeder services and further market concentration. The exact implications this development may have with respect to exploitation of market power are still unknown [127][120][70].

Consolidation in container trades is also reflected in the growth of key ports as shown in *Table 7*. The average annual growth rate for the ten largest ports was 7.8 percent between 1995 and 2001. This is close to the overall growth of container trades over the same period. Some ports have grown at extreme rates, especially Shanghai. Others have grown slower than the average. Since the largest ports on the whole have not grown more than the market, it is not evident that the markets are becoming more concentrated. On the other hand, it is surprising from a broader perspective that the existing ports have been able to retain their market shares even in a market which grows by 7-9 percent per year and has done so for decades. In many other markets,

such high growth rates would lead to entry, and a significant higher number of competitors; not only increased production among the existing ones.

Regardless of market segment, the most prominent feature of the development of global shipping markets over the last 30 years is the geographical move of market dominance towards Asia, away from the historical core regions in Europe and North America. Some of this is a result of long-term trends in international trade and growth that affect various transport segments. Even if shipping can be managed over long distances, there are always transaction costs of operating in foreign markets. Increasing inter- and intra-regional trade to and from emerging economies in Asia will, therefore, inevitably spur Asian investments in the industry.

Lower transportation costs and other transaction costs have had great impact on global production, incomes and trade patterns. Shipping productivity continues to increase by any broad definition that measures output relative to input. Such improvements also have implications for the shipping industry as they lay the ground for new schemes of production and operations. The industry is highly international, and the location and resources chosen for specific activities will be driven by needs to minimise costs. As long as international labour markets are not perfectly competitive, the implications have been dramatic for shipping in the rich countries of Europe and North America.

Most ships in international trades are manned by people from countries with low wages, and accordingly comparative advantage in labour intensive production. Rapid economic growth in some countries, and less growth in others have caused similarly rapid changes in the most common nationality of crews in many market segments. Norwegian sailors, once the basis for the growth of Norwegian shipping, are hard to find nowadays. South Korea took over Japan's position as the world's largest producer of ships in 2002, as sufficient skills have been developed while Korean wages are still relatively low. Still, the Busan port authorities, who have been extremely successful in attracting container traffic during the 1990s, are already seriously worried about how to resist competition from Chinese ports based on lower wages [15].

All this is part of a larger picture of international business life cycles, where most innovations, and the most advanced operations at the time, take place in countries with the highest level of education, skills and wages. As economies grow and industries mature, the simpler production processes move to countries with lower wages. *Chapter 2* gives more details on how this has led to dramatic changes for maritime industries and maritime nations over the 20th century.

The only viable response from rich countries, such as Norway and the Netherlands, to the dynamic economic environment described above, is to exploit comparative advantage in human capital. Some aspects of the practical implementation, which obviously must include emphasis on innovation and education efforts, are discussed later in this book.

1.7. Political events and decisions

Shipping is highly influenced by political events and decisions like most other businesses. A complete treatment of this topic would easily turn the chapter into a book, so the discussion below is limited to a few issues where fundamental changes in the world economy may affect international shipping markets more generally. Specific policy issues related to maritime clusters are discussed in *Chapter 9*.

Technological characteristics, combined with the crucial importance of the commodities transported by sea, make shipping markets exposed to international politics. Many market segments are volatile, because supply is typically constrained in the short run, while demand fluctuates due to global and regional market shocks, which are often driven by political events. The average profit from operations under normal conditions is often too low to cover all capital costs, and the financial foundation for investment is established in periods with political crisis and war.

One question of interest is whether the overall uncertainty of shipping is likely to change. The past two years, with focus on international terrorism in the aftermath of the attacks on September 11, 2001, have been characterised by increasing security concerns and security costs of all categories for shipowners and other market players. The situation may be different when it comes to market shocks of specific security crises in the future. Nobody knows what might happen if an international terrorist organisation gets access to weapons of mass destructions. Except from that possibility, most of the long-term characteristics that have been described, indicate that international security policy will have a lesser impact on the shipping markets in the years to come. Economic growth, production and consumption is spreading to an increasing number of regions and countries. This implies that regional demand and supply shocks will make less of a difference. Changes in direct shipping demand due to war needs are also less important now, than before. For example, the build-up of American military forces prior to the invasion of Iraq in 2003 created a temporary increase in uncertainty, but had little direct impact on the markets in terms of physical shipments.

Another issue of interest is international environmental politics. In a study of the prospects for Norwegian shipping, Minsaas et al [68] name environmental policy, the main ”joker” for future shipping markets. This is due to several unresolved questions. First of all, there is increasing concern for global carbon emissions, which are thought to create global warming. The Kyoto protocol has not been ratified by the required number of countries. Whenever that may happen, the protocol will encourage use of energy sources other than oil products dominating the shipping markets. The implied change for the world’s energy markets and shipping markets will generally be negative, but the magnitude is highly uncertain.

There is also increasing environmental concern for the local emissions from international shipping. Traditionally, shipping has been exempted from many environmental regulations that other industries are faced with, but this unique position may well change. The European Union is about to introduce a close-to-zero emission

regime for shipping in EU waters. That could become costly for the industry, until the costs eventually are transferred to the customers. New requirements may, however, also represent an opportunity for the industry. One may hope that they can spur industrial innovation within the maritime industries and clusters in Europe.

1.8. Final remarks

This chapter started with a brief discussion on various kinds of clusters, emphasising that clustering of maritime industries is just one example among many others in the global economy. International trade, economic growth and international policy are key drivers for the development of international shipping markets. The rest of the presentation demonstrated a world economy in rapid change.

There is extensive growth of production and income for the world as a whole and even higher growth of international trade. Drastic changes in the regional distribution of production, trade and income also take place. These changes not only affect the pattern of seaborne trade, but also the industrial structure of international shipping.

One main conclusion stands firm: East and South East Asia becomes increasingly more important to international shipping in virtually any respect. In order to place this finding in a broader perspective, one should note that the maritime industries are not at all unique. The introduction mentioned cities as the largest, most complete and dense geographical clusters in the world. Cities are also subject to change as a natural part of global economic development. *Table 8* illuminates this fact, showing the size of the world's 10 largest cities, or metropolitan areas, in 1900 and 2000.

Year 1900		Year 2000	
City	Population (million)	City	Population (million)
London	6.5	**Tokyo**	26.4
New York	4.2	Mexico City	18.1
Paris	3.3	**Bombay**	18.1
Berlin	2.7	**Sao Paulo**	17.8
Chicago	1.7	**New York**	16.6
Vienna	1.7	**Lagos**	13.4
Tokyo	1.5	**Los Angeles**	13.1
St. Petersburg	1.4	**Calcutta**	12.9
Manchester	1.4	**Shanghai**	12.9
Philadelphia	1.4	**Buenos Aires**	12.6

Table 8: Population of the world's 10 largest metropolitan areas in 1900 and 2000[5]

Table 8 contains at least three elements of interest. First, one can observe that the total population of all of the ten largest cities hundred years ago was smaller than the single largest one today. Total population of the ten largest cities increased more than six-

[5] Source: O'Meara [73] and United Nations Population Division 2000 as cited in [125]. Definitions and statistics of metropolitan areas are a matter of dispute. See for example Brinkhoff [13], where Seoul and Delhi, which are not part of *Table 8*, are ranked four and seven among the largest cities in the world.

fold between 1900 and 2000. This is far more than growth of world population, so population growth cannot by itself explain the tendency of increased clustering.

Second, there is a shift away from Europe and the United States, towards Asia. This reflects population growth but, to some extent, also economic growth. Nine of the ten largest cities in 1900 were European or American; only two remain in 2000. One of them, Los Angeles, is particularly interesting. The population of Los Angeles was only about 100.000 in 1900. Now the city hosts one of the most famous industry clusters in the world, Hollywood. It also hosts another, not so famous cluster. The two container ports in the Los Angeles area, Los Angeles and Long Beach, represent combined the third largest port complex in the world. As *Table 7* shows, they would only be beaten by Hong Kong and Singapore if considered as one cluster.

Finally, most of the densely populated areas in the world are located close to oceans or other main waterways. In *Table 8*, the name of cities located in proximity to the sea are written in bold. Five cities on the list from 1900 are of this kind. All the current largest cites, except Mexico City, fall in this category. Proximity to oceans, and shipping services, seems indeed to be important for growth.

2. THE RISE AND FALL OF MARITIME NATIONS

2.1. Introduction

Some of the maritime industries have been for centuries part of the global economy and they have to face new and low cost competitors over and over again. In the past, their competitive position was to a large extent determined by technological innovation, exemplified by the two shifts in propulsion from wind power to steam engine power and from steam engine power to diesel engine power. In the second half of the 20th century, the economic positions of the traditional maritime countries were challenged by the newly industrialised countries. Shipbuilding is one of the maritime industries which suffered the most from the new competition of countries like Japan and later on South Korea and currently China. Consequently, the labour force at West-European shipyards declined dramatically between 1975 and 2002 as *Table 9* illustrates.

Labour force	1975	2002
Belgium	10,245	0
Croatia	n.a	10,957
Denmark	18,900	3,360
Finland	18,000	6,150
France	40,354	6,800
Germany	105,988	23,300
Greece	10,159	3,000
Ireland	1,633	0
Italy	36,260	13,438
Netherlands	39,850	9,000
Norway	29,000	5,266
Poland	n.a	20,132
Portugal	17,100	2,350
Romania	47,000	20,400
Spain	n.a.	7,876
Sweden	31,500	0
United Kingdom	55,999	7,000
Total	**461,988**	**136,029**

Table 9: European shipyard labour force 1975 and 2002 [5][6]

The data for the base year 1975 for the countries Croatia, Poland and Spain is not available. If these numbers should have been added, than the reduction in the labour force at the European shipyards would have even exceeded the current 70 percent. The displacement of so many workers created major social and political problems, which in some countries continue to dominate the political agenda. However, the loss (fall) for European shipbuilding countries means a gain (rise) for other countries, in

[6] These figures include repair and new building work forces at European shipyards.

particular in Japan and South Korea. These countries will in turn be challenged by China. And so the cycle will continue to repeat itself over and over again. Structural changes have not only taken place in world shipbuilding, but also in world shipping, fisheries, ports, navies, offshore and so on. The structural changes in these markets and the consequent rise and fall of maritime nations will be explored in the following paragraphs, as they provide insight into the fundamentals behind the maritime industry benchmarks.

2.2. Shipbuilding

World shipbuilding 1947-2002

The *Shipping Statistics Yearbooks* of the Institute of Shipping Economics and Logistics[7] (ISL) in Bremen provide a unique and consistent source of data, upon which the following graphs and the following analysis is based. The base year is 1961 and the last year is 2001, covering a period of 40 years. The 2002 figures are taken from the AWES Annual Report 2002-2003. *Figure 4* shows the world shipbuilding output over the 55-year period from 1947 to 2002 amounting to 911 million gt.

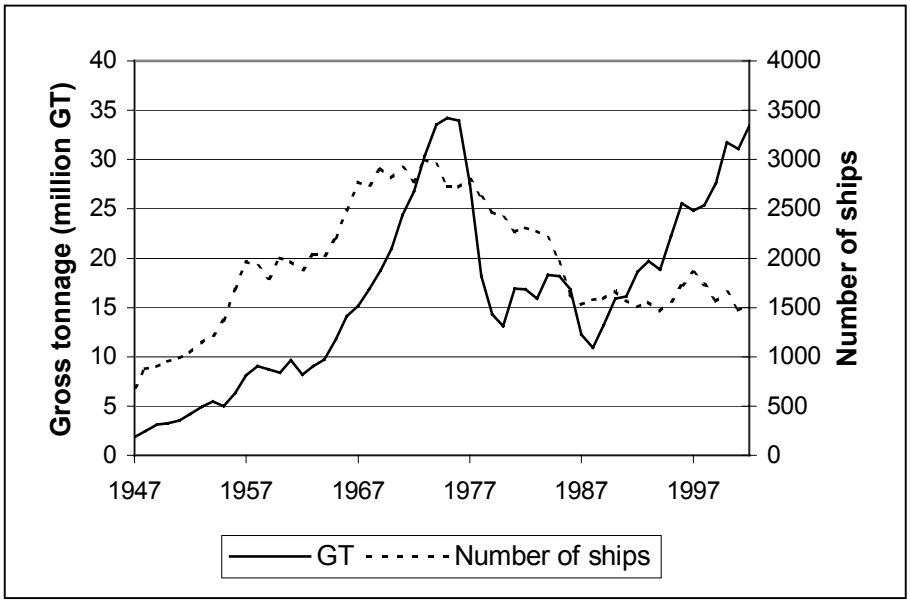

Figure 4: World shipbuilding output 1947-2002

During this period 108,000 ships were built. On average almost 2,000 ships per annum, with a peak production of 3,000 in the early 1970s and the rather stable number of 1,500 since the mid-1980s. The output of the major shipbuilding nations over the period 1961-2002 is briefly summarised in the following sections. The world output was over this 41-year period 840 million gt, and almost 89,500 ships.

The Netherlands

The shipbuilding output of the *Netherlands* over the period 1961-2002 amounted to 14 million gt, and consisted of almost 4,300 ships, or on average 105 ships per annum

7 http://www.isl.org

with an average gross tonnage of almost 3,300 gt. The Dutch are clearly specialists in small ships. The share of the Netherlands measured in gt is 1.7% and 4.8% in number of ships. In the most recent year 2002, the share in world output was 0.84% on the basis of gross tonnage, 2.2% on the basis of compensated gross tonnes, and 7.2% on the basis of number of ships.

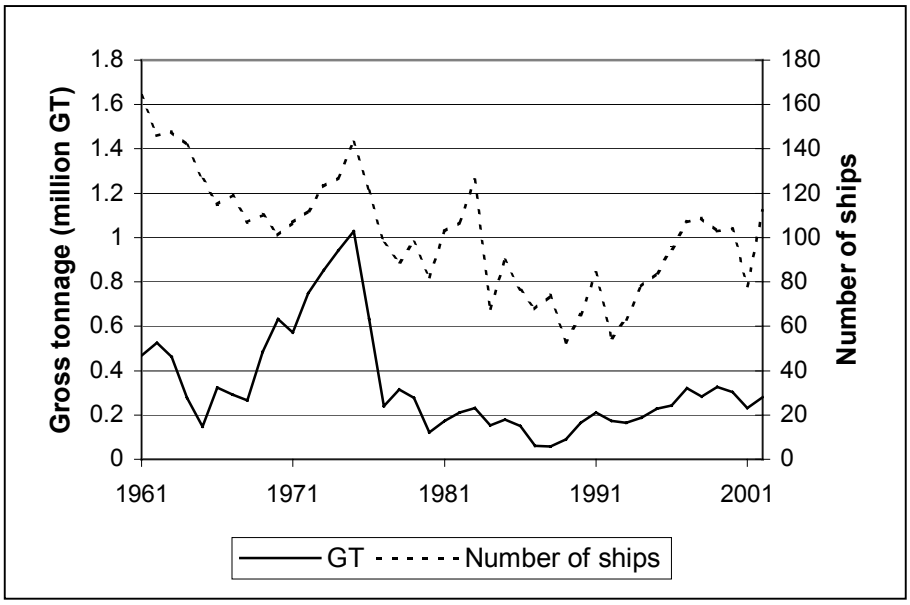

Figure 5: The Netherlands' shipbuilding output 1961-2002

After the rapid expansion in the 1970s, the contraction and restructuring in the Netherlands was painful but fast. Consequently, a new industry model emerged for the shipyards. The yard became the assembly plant where many subcontractors contributed to the construction. A flexible and low cost shipbuilding and marine equipment sector was the end result which specialises in relatively small ships. It is remarkable that the Dutch shipyards are able to produce on average 5% of the number of ships in the world and in 2002 even 7%.

Norway

The shipbuilding output of *Norway* over the period 1961-2002 amounted to 15 million gt. and consisted of 3,350 ships, or on average 82 ships per annum with an average gross tonnage of almost 4,500 gt. The Norwegians are like the Dutch clearly specialists in smaller ships. The share of Norway measured in gross tonnage is 1.8% and 3.7% in number of ships. In the most recent year 2002, the share in world output was 0.8% on the basis of gross tonnage, 2.6% on the basis of compensated gross tonnes, and 5% on the basis of number of ships.

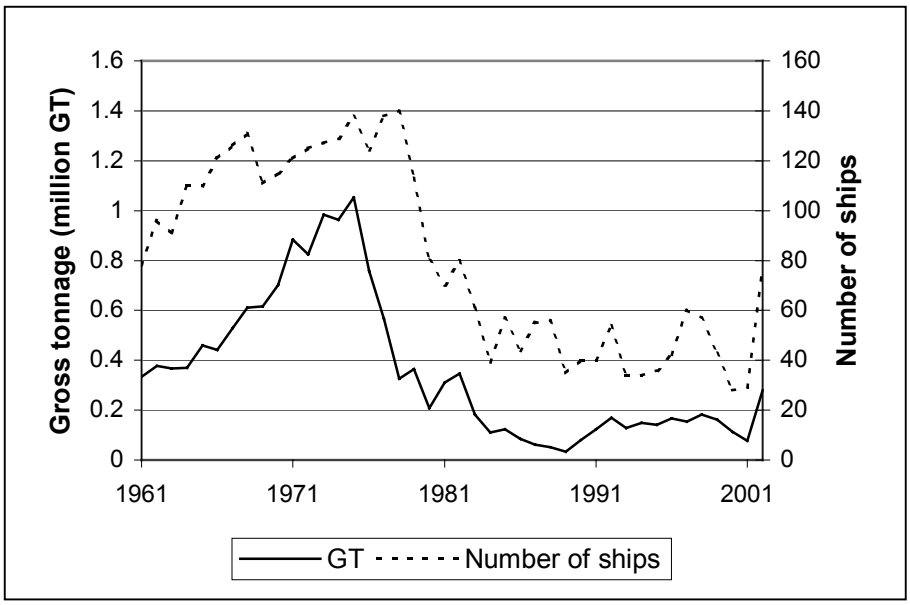

Figure 6: Norway's shipbuilding output 1961-2002

After the restructuring following the second oil crisis in 1979, a number of yards has been struggling to maintain a critical mass in shipbuilding. Their output has fallen dramatically in recent years to below 30 ships per annum, although the output has risen sharply in 2002 to 77 ships. The yards have specialised in offshore ships, stimulated by the phenomenal growth of the Norwegian offshore sector, after the oil crises.

Denmark

The shipbuilding output of *Denmark* over the period 1961-2002 amounted to 21.2 million gt, and consisted of 1,700 ships, or on average 41 ships per annum with an average gross tonnage of almost 12,500 gt. The Danish built on average larger ships than the Dutch and Norwegians. The share of Denmark measured in gross tonnage is 2.5% and 1.9% in number of ships. In the most recent year 2002, the share in world output was 1.3% on the basis of gross tonnage, 1.5% on the basis of compensated gross tonnes, and 1% on the basis of number of ships.

Danish shipbuilders produced in 2002 a few ships and these were mostly for a captive owner. The declining trend in output since 1973, especially measured in numbers, raises serious questions about the shipyard viability in this country in the near future.

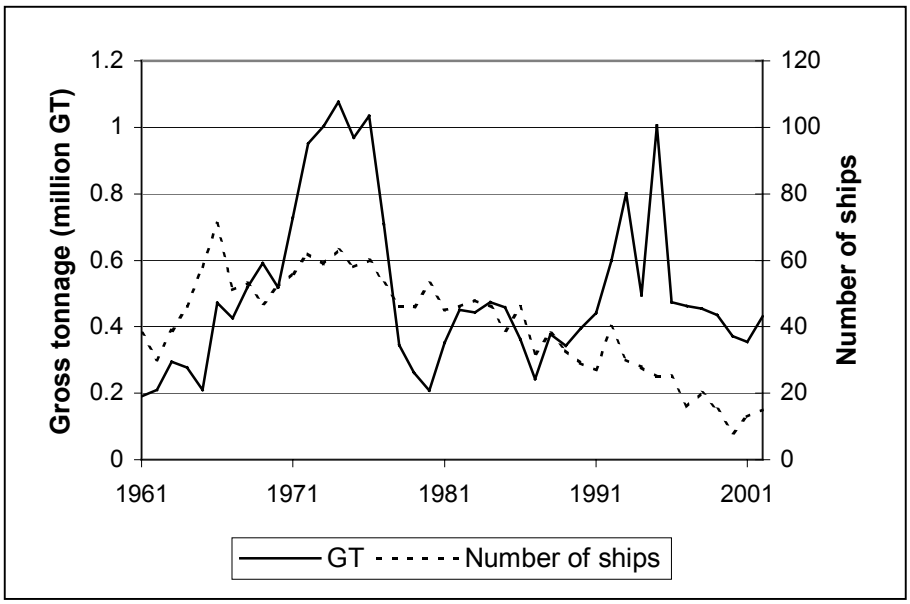

Figure 7: Denmark's shipbuilding output 1961-2002

Germany

The shipbuilding output of *Germany* over the period 1961-2002 consists of two statistics: before 1990 and thereafter, when Eastern Germany was reunited with Western Germany. In the statistics the East German output is added as from 1966 – 1989. The total output amounted to 53.9 million gt (of which 7.9 million for Eastern Germany), and consisted of 7,018 ships, or on average 170 ships per annum with an average gross tonnage of almost 7,600 gt. The Germans built on average larger ships than the Dutch but smaller than the Danish. The share of Germany measured in gross tonnage is 6.3% and 7.8% in number of ships.

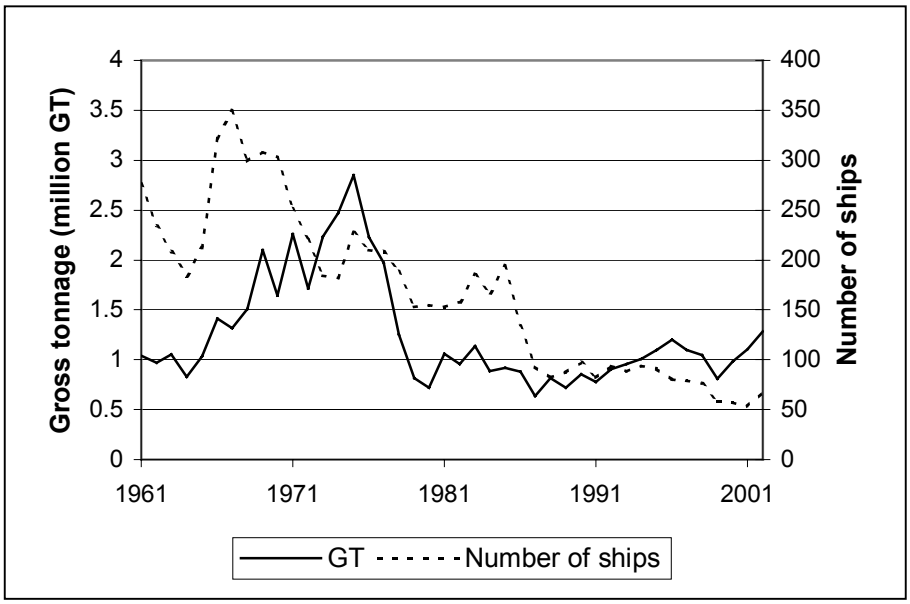

Figure 8: Germany's shipbuilding output (including GDR) 1961-2002

In the most recent year 2002, the share in world output was 3.8% on the basis of gross tonnage, 5.7% on the basis of compensated gross tonnes, and 4.4% on the basis of

number of ships. Germany is currently the largest shipbuilding country in Europe in terms of cgt.

France

The shipbuilding output of France over the period 1961-2002 amounted to 19.6 million gt, and consisted of 1,840 ships, or on average 45 ships per annum with an average gross tonnage of almost 10,700 gt. The French built on average larger ships. The share of France measured in gross tonnage is 2.3% and 2% in number of ships. In the most recent year 2002, the share in world output was 0.8% on the basis of gross tonnage, 1.6% on the basis of compensated gross tonnes, and 1.2% on the basis of number of ships.

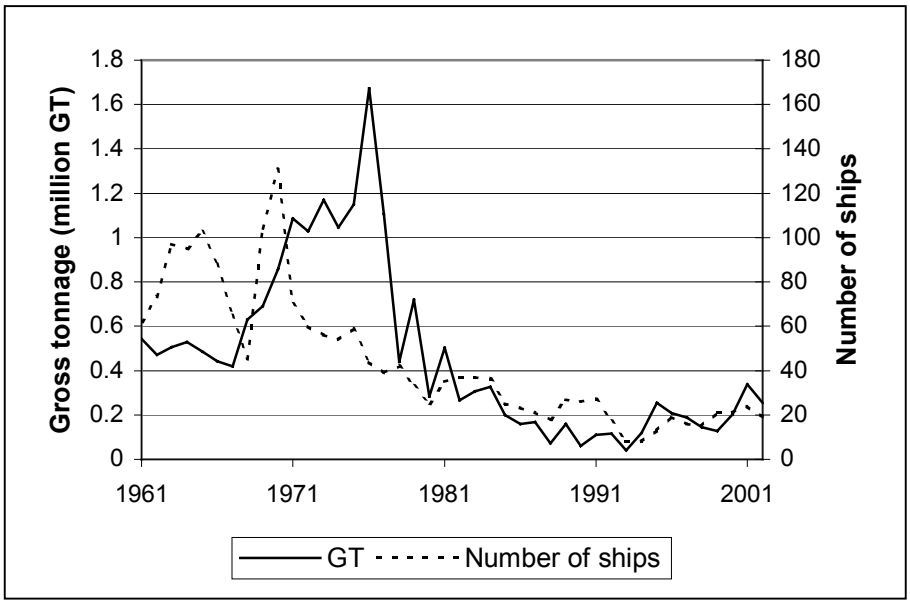

Figure 9: France's shipbuilding output 1961-2002

France became a leading shipbuilding country in the early-1970s, but had to restructure its yards when new tanker orders dried up in the aftermath of the second oil crisis. Now it maintains a certain position in cruise vessels. The critical mass of the yards has to be maintained if it is to have a future.

Spain

The shipbuilding output of *Spain* over the period 1961-2002 amounted to 23.1 million gt, and consisted of 4,820 ships, or on average 118 ships per annum with an average gross tonnage of almost 4,800 gt. The Spanish built on average small ships. The share of Spain measured in gross tonnage is 2.8% and 5.4% in number of ships. In the most recent year 2002, the share in world output was 0.6% on the basis of gross tonnage, 1.4% on the basis of compensated gross tonnes, and 3.3% on the basis of number of ships.

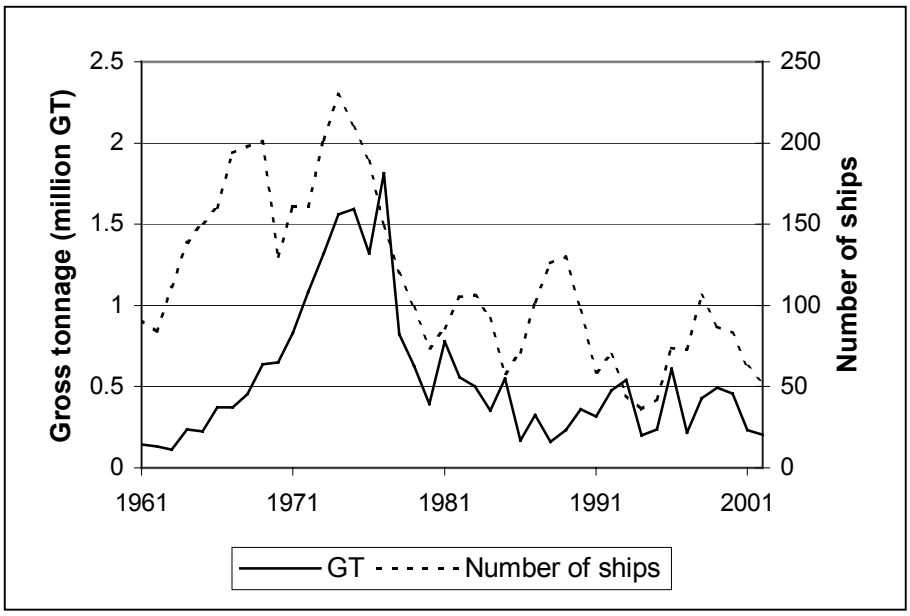

Figure 10: Spain's shipbuilding output 1961-2002

Spain went, like most of the other European countries through a major restructuring. The extensive government support during this post-oil crisis period has helped to maintain the current shipyard capacity and output.

United Kingdom

The shipbuilding output of the *United Kingdom* over the period 1961-2002 amounted to 25.5 million gt, and consisted of 3,420 ships, or on average 86 ships per annum with an average gross tonnage of almost 7,500 gt. The UK built on average medium size ships. The share of the UK measured in gross tonnage is 3% and 3.8% in number of ships. In the most recent year 2002, the share in world output was nil.

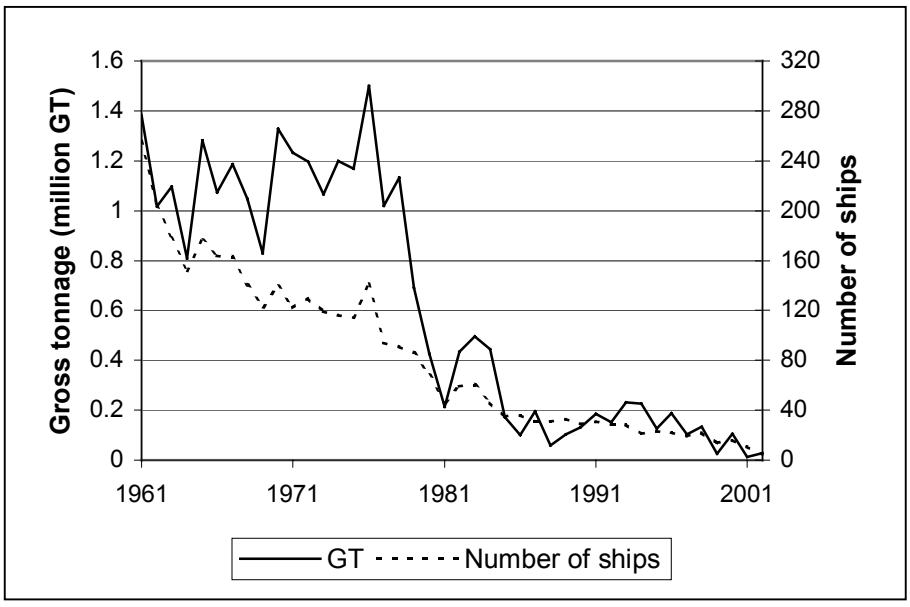

Figure 11: United Kingdom's shipbuilding output 1961-2002

The United Kingdom was during the steam era the foremost shipbuilding nation in the world. It was able to make the transition to the diesel engine era and was in 1961 one of the leading shipbuilding nations in the world, with an output of 1.4 million gt and more than 250 ships. The UK has not been able to restructure its merchant shipbuilding industry and in 2002 it almost stopped building merchant vessels. The end of a once mighty industry, as a newspaper summarised the situation.

Italy

The shipbuilding output of Italy over the period 1961-2002 amounted to 20 million gt, and consisted of 1,680 ships, or on average 41 ships per annum with an average gross tonnage of almost 11,900 gt. Italy built on average larger size ships. The share of Italy measured in gross tonnage is 2.4% and 1.9% in number of ships. In the most recent year 2002, the share in world output was 1.9% on the basis of gross tonnage, 3% on the basis of compensated gross tonnes, and 1.2% on the basis of number of ships

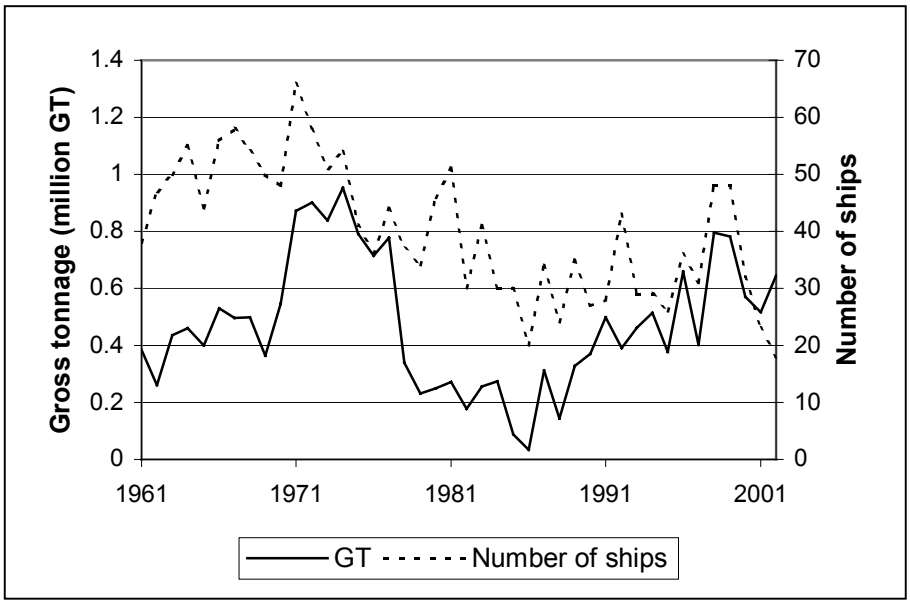

Figure 12: Italy's shipbuilding output 1961-2002

Italy is a country like Spain where extensive government support has resulted in a bouncing back of shipbuilding output after the tanker boom of the 1970s. In the last decade output in gt increased to pre-oil crisis levels. Italy has also succeeded in building many cruise vessels, which is one of the reasons behind the relatively high share on a cgt basis.

Finland

The shipbuilding output of *Finland* over the period 1961-2002 amounted to 9.4 million gt, and consisted of 1,020 ships, or on average 25 ships per annum with an average gross tonnage of almost 9,200 gt. Finland built on average larger ships. The share of Finland measured in gross tonnage is 1.1% and 1.1% in number of ships. In the most recent year 2002, the share in world output was 0.9% on the basis of gross tonnage, 1.7% on the basis of compensated gross tonnes, and 0.4% on the basis of number of ships.

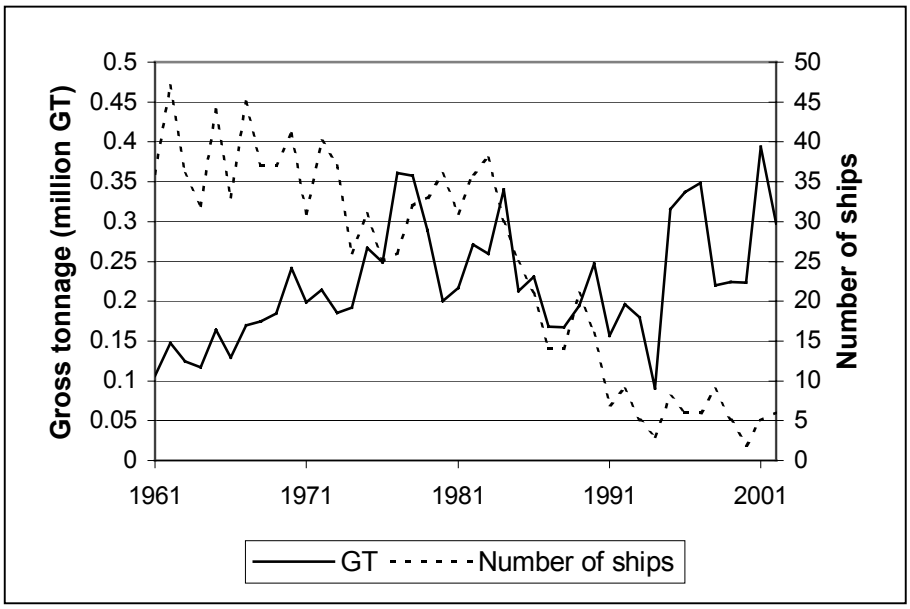

Figure 13: Finland's shipbuilding output 1961-2002

Finland is a particular case in Europe as it was until 1990 to a large extent dependent upon the shipbuilding orders of the former Soviet Union. When these orders stopped, its shipbuilding industry more or less collapsed, although it still is one of the technology leaders in the world. Its relatively high cgt share comes from the cruise vessel construction.

Sweden

The shipbuilding output of *Sweden* over the period 1961-2002 amounted to 30.9 million gt, and consisted of 1,270 ships, or on average 31 ships per annum with an average gross tonnage of almost 24,300 gt. Sweden built on average very large size ships. It ceased more or less building ships in 1985. The share of Sweden measured in gross tonnage is 3.7% and 1.4% in number of ships, which is considerable as hardly any new buildings have been delivered since 17 years.

Sweden was one of the most successful and innovative shipbuilding countries; the first bulk carrier Cassiopeia was built there in the mid-1950s, it rode the wave of tanker new buildings, and it still is the third largest builder in the world behind Japan and South Korea measured over the last 41 years. The restructuring of the shipyards was not successful and the country missed an alternative like the Norwegians had in the booming offshore industry. Sweden is a country that rose fast as a shipbuilding nation, but fell even faster and dead to the ground like no other country.

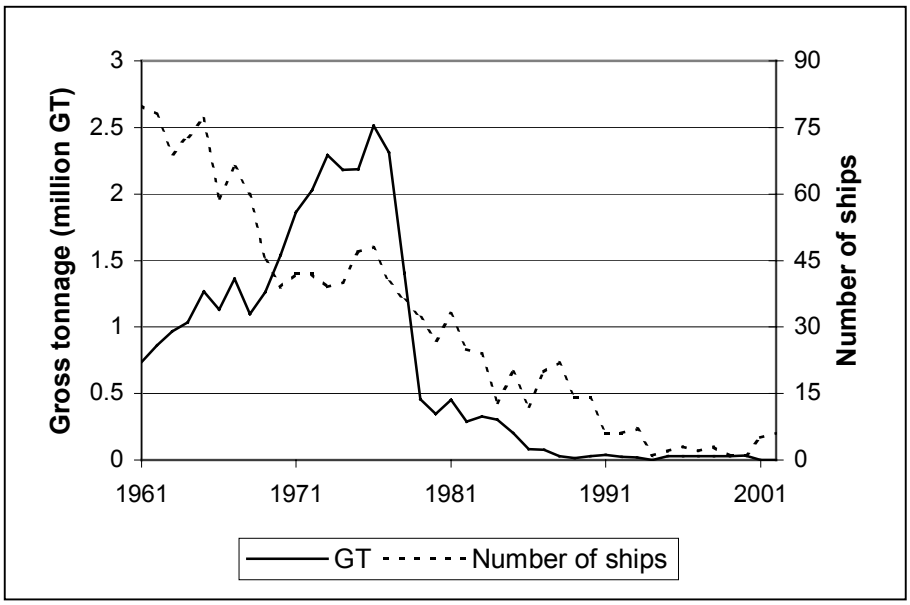

Figure 14: Sweden's shipbuilding output 1961-2002

Poland

The shipbuilding output of *Poland* over the period 1961-2002 amounted to 17.6 million gt, and consisted of 2,260 ships, or on average 55 ships per annum with an average gross tonnage of almost 7,800 gt. Poland built on average medium size ships. The share of Poland measured in gross tonnage is 2.1% and 2.5% in number of ships. In the most recent year 2002, the share in world output was 1.7% on the basis of gross tonnage, 2.3% on the basis of compensated gross tonnes, and 1.9% on the basis of number of ships.

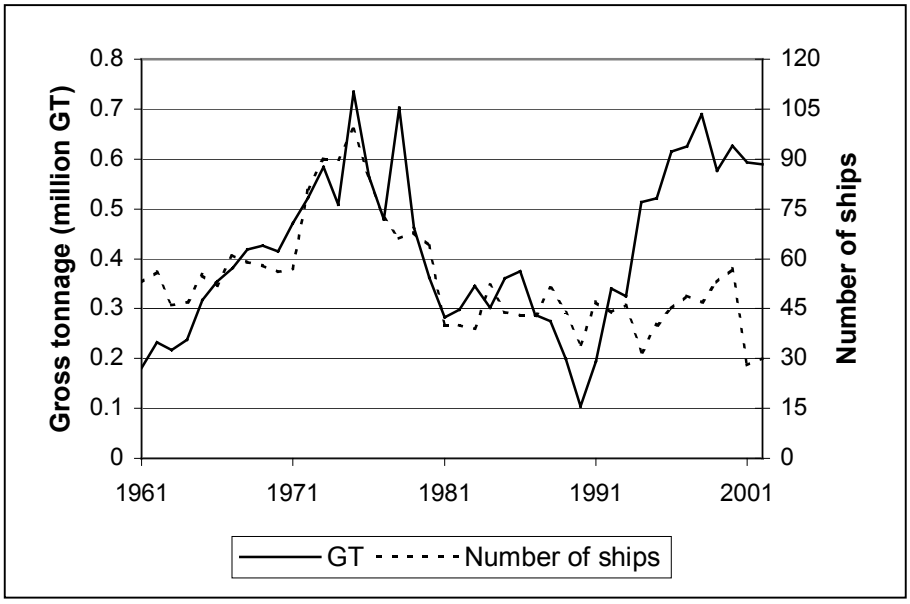

Figure 15: Poland's shipbuilding output 1961-2002

Poland went through a severe restructuring like all the other countries, but even without a massive government assistance it staged a remarkable comeback in the early 1990s after the collapse of the communist world of which it was part. The rise in

labour costs caused a bankruptcy of one of the major shipyards, while other yards struggle to survive.

There is a number of European shipbuilding nations which are not mentioned here, like Belgium and the former Yugoslavia. Belgium has stopped all new buildings a number of years ago, while the former Yugoslavia has fallen apart. Croatia produced 17 ships in 2002 with a gross tonnage of 417,041 gt. There are four more countries that have been or are relevant in world shipbuilding: United States of America, Japan, South Korea, Taiwan and China. These countries will be discussed below, with the exception of Taiwan.

United States

The shipbuilding output of the *United States of America* over the period 1961-2002 amounted to 14 million gt and consisted of 4,750 ships, or on average 116 ships per annum with an average gross tonnage of almost 3,000 gt. The USA built on average small size ships. The share of the USA measured in gross tonnage is 1.6% and 5.3% in number of ships. In the most recent year 2002, the share in world output was 0.5% on the basis of gross tonnage, 1.3% on the basis of compensated gross tonnes, and 4.3% on the basis of number of ships.

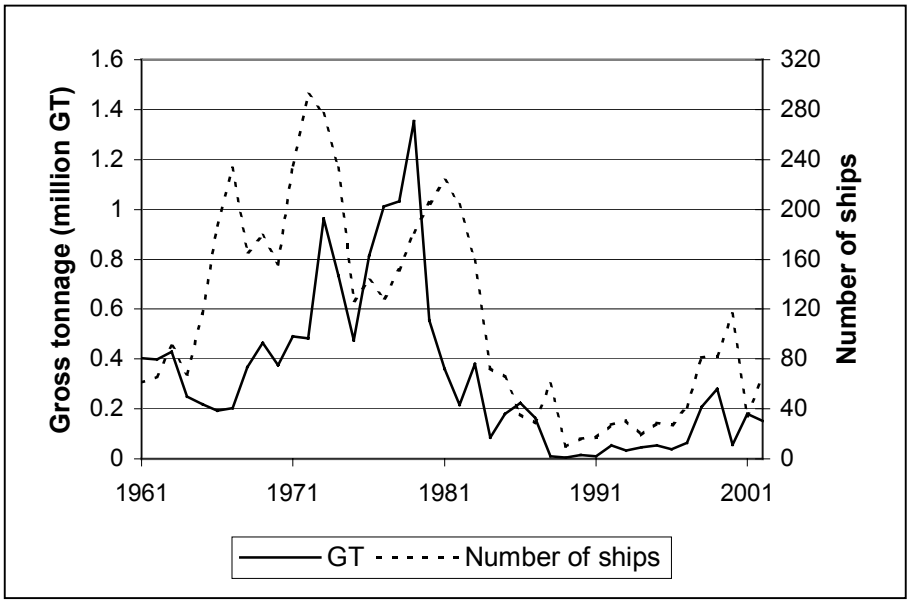

Figure 16: US' shipbuilding output 1961-2002

Shipbuilding output reached a peak of 1.4 million gt during the year of the second oil crisis. The output diminished rapidly thereafter and almost became zero in 1990. It picked up a bit in the late 1990s because of special financial arrangements for US-built ships operating in US waters. US shipbuilding was extremely innovative during the World War II period when it introduced new and highly productive ways to build ships like the Victory's, the Liberties and T2 Tankers. It currently has a large naval shipbuilding industry which is not exposed to world competition.

Japan

The shipbuilding output of *Japan* over the period 1961-2002 amounted to a staggering 365 million gt, and consisted of 31,800 ships, or on average 775 ships per annum with an average gross tonnage of almost 11,500 gt. Japan built on average large size ships. The share of Japan measured in gross tonnage is 43.5%(!) and 35.5% in number of ships. In the most recent year 2002, the share in world output was 35.8% on the basis of gross tonnage, 30.7% on the basis of compensated gross tonnes, and 25.6% on the basis of number of ships.

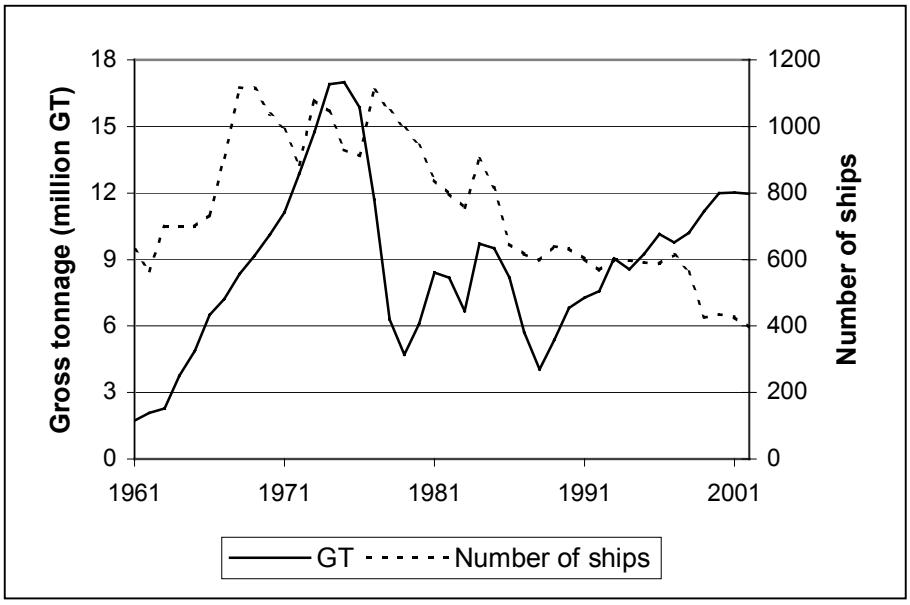

Figure 17: Japan's shipbuilding output 1961-2002

In 1961 Japan had already a shipbuilding output of 1.7 million gt and 627 ships. It was by far the largest shipbuilding nation, long before the oil tanker boom of the late 1960s and 1970s. Over a 41-year period it constructed almost 44% of the world fleet in gross tonnage terms and almost 36% in number of ships. It is amazing that even today Japan has maintained this kind of share in output. The reason behind this success is a very innovative drive in production technology; Japan still has the highest shipbuilding productivity and continuously improves its performance. Therefore, countries like South Korea and China have a hard time in competing with this country even if their wage levels are much lower.

South Korea

The shipbuilding of *South Korea* over the period 1961-2002 started in 1973 and amounted to a staggering 119 million gt over the remaining 29 years, and consisted of 3,310 ships, or on average 114 ships per annum with an average gross tonnage of almost 36,000 gt. Korea built on average very large size ships. The share of Korea measured in gross tonnage is 14.2% and 3.7% in number of ships since it entered the international shipbuilding market in 1973. In the most recent year 2002, the share in world output was 38.8% on the basis of gross tonnage, 31.1% on the basis of compensated gross tonnes, and 15.3% on the basis of number of ships

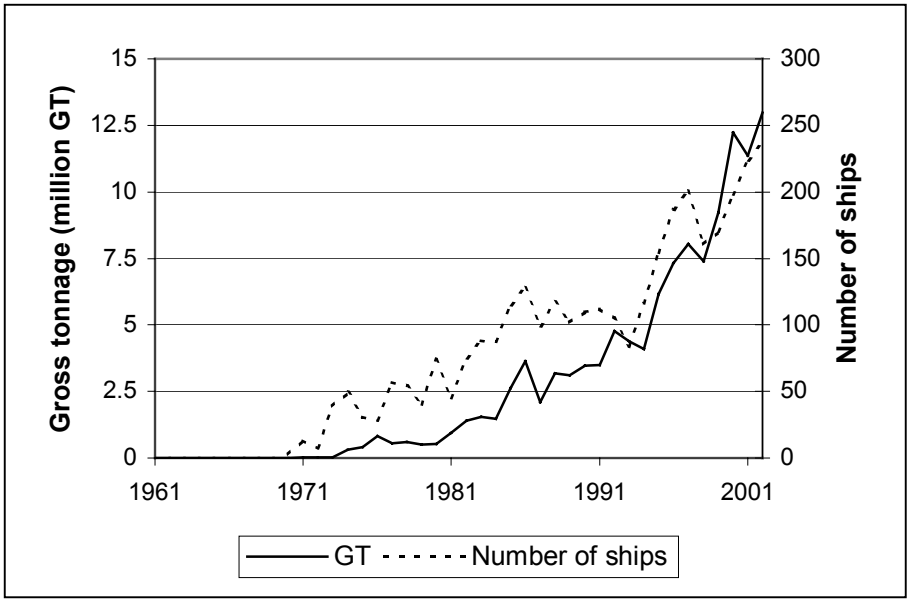

Figure 18: South Korea's shipbuilding output 1961-2002

South Korea has aggressively expanded its shipbuilding capacity and aims to become the largest shipbuilder in the world. It has been successful by a combination of efficient production techniques and financial engineering. Currently the European Commision has started a WTO procedure against South Korea, which they accuse of price dumping. The European Commission made a detailed study of material costs in South Korea and in EU countries in 1999 and an update in 2002. *Table 10* illustrates the average difference by marine equipment category in those years. The average price gap has narrowed from 25% in 1999 to 19% in 2002.

Marine equipment category	Average difference 2002 (%)	Average difference 1999 (%)
Propulsion systems/main engines	-17	-25
Auxiliary engines and generators	-20	-22
Cargo handling/deck machinery	-22	-26
Other major systems	-19	-27
other	-20	-28

Table 10: European and South Korean costs differences

P.R. China

The shipbuilding output of the P.R. of China over the period 1961-2002 started only in the 1980s, but really took off in 1992. The output amounted to 17 million gt and consisted of 1,700 ships. The share of China measured in gross tonnage is 2% and 1.9% in number of ships since it entered the international shipbuilding market in the 1980s.

In the most recent year 2002, the share in world output was 6.7% on the basis of gross tonnage, 7.3% on the basis of compensated gross tonnes, and 9.9% on the basis of number of ships.

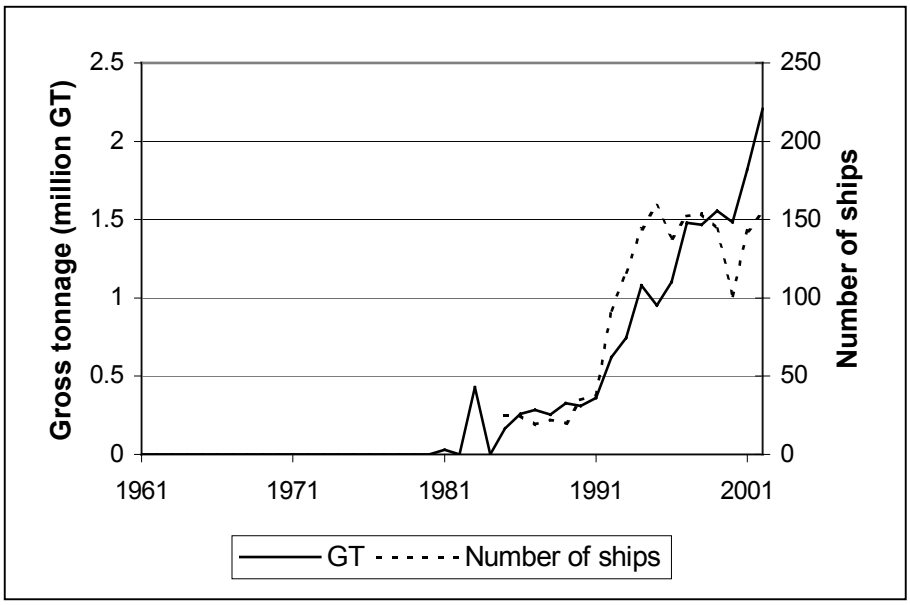

Figure 19: China's shipbuilding output 1961-2002

Rise and fall of shipbuilding nations 1961–2002

World shipbuilding output over the 41-year period amounted to 840 million gt. Fifteen countries contributed 90% to the world output in gross tonnage, and 83% in terms of number of ships.

If one compares this ranking over a 41-year with the ranking in the year 2002, then it may be concluded that the concentration of world shipbuilding output has further advanced. Some countries have more or less disappeared, like the United Kingdom and Sweden; some countries have grown, like South Korea and China. Another group of countries managed to remain more or less at the same ranking or remain more or less at the same ranking, like Germany, Poland and Italy. Most striking, however, is the dominance of the two countries, Japan and South Korea, which together produced 75%(!) of world shipbuilding output in gt in 2002. *Figure 20* shows the average share of shipbuilding countries in output (measured in gt) over the 41-year period, compared to their share in 2002. This clearly illustrates the rise and fall of shipbuilding nations.

Figure 21 shows a similar graph for the number of ships that has been produced by each country. This picture is quite different. Not for Japan, South Korea and China, as they still take the first three positions. However, the Netherlands and Norway are also important, as they take the fourth and fifth position in 2002. For a country it is more important to produce a large number of ships, than to produce a large gross tonnage. Each ship needs very expensive marine equipment and the value added by this equipment is much higher than the value added by the steel that goes into the ship's hull.

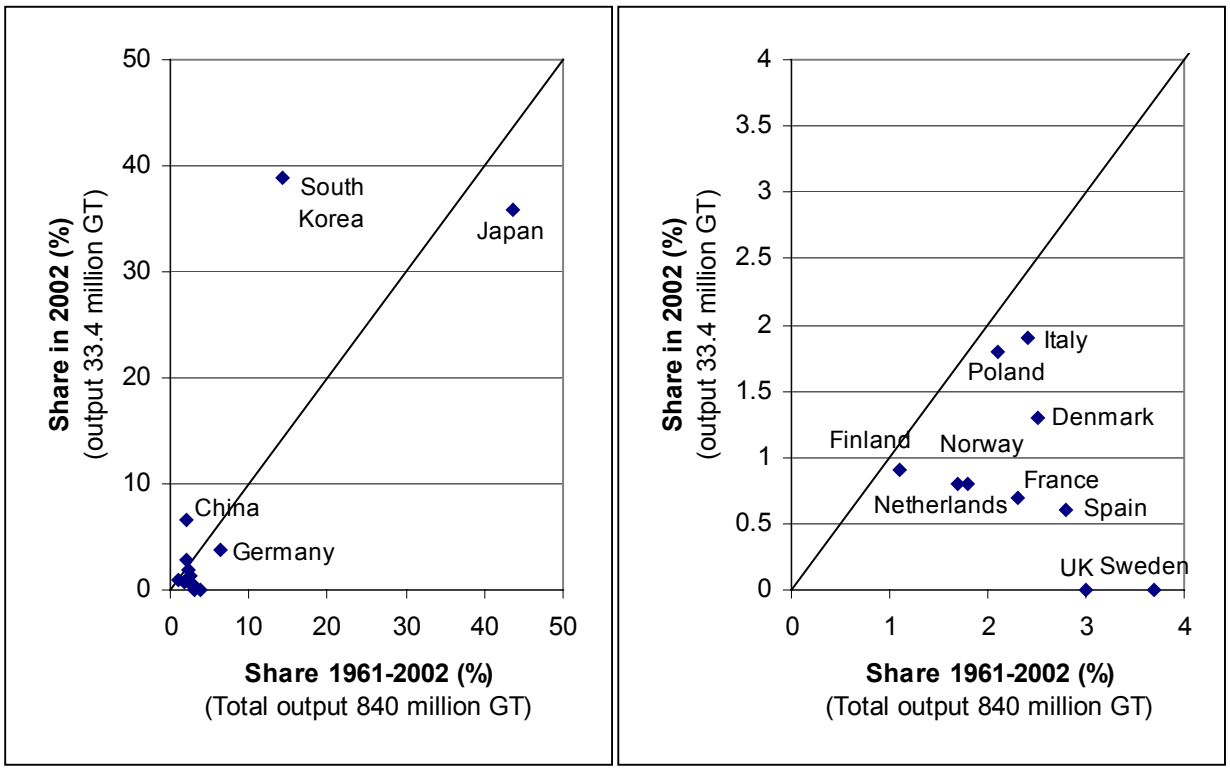

Figure 20: World shipbuilding output ranking in gt

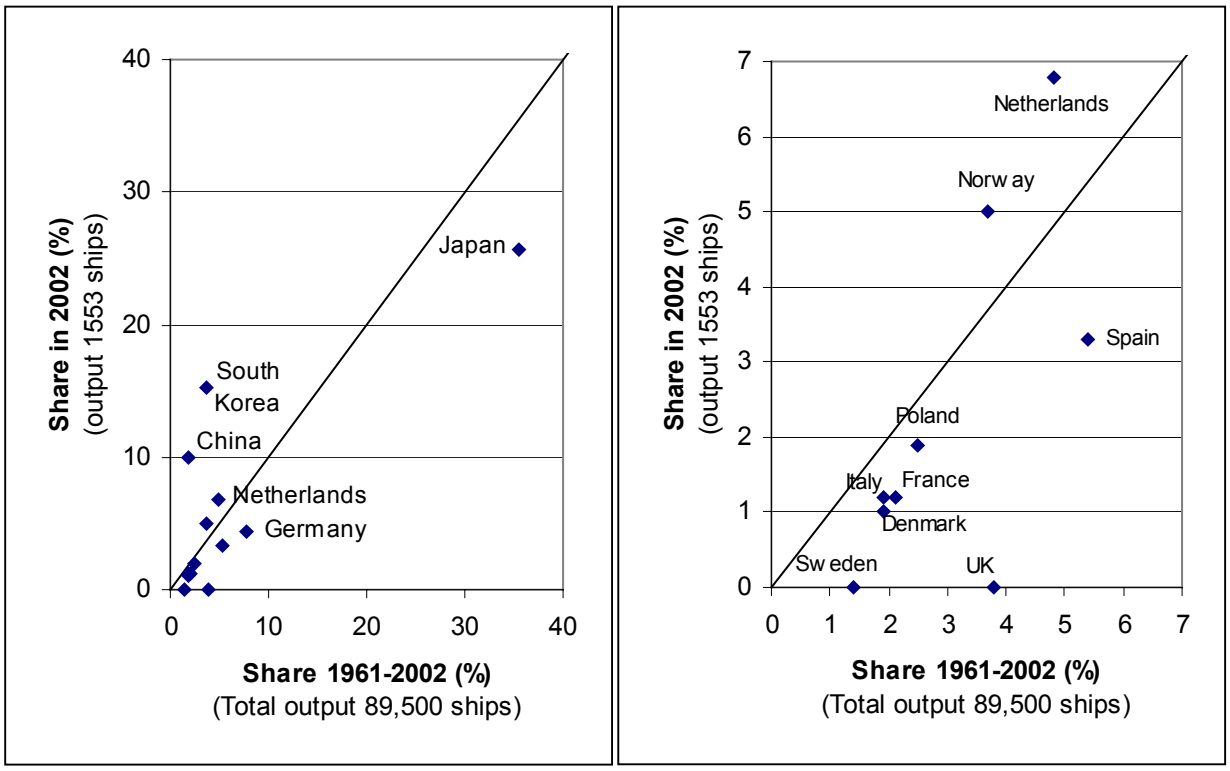

Figure 21: World shipbuilding output ranking in number of ships

This analysis shows that the shipbuilding market is in fact made up of two very big shipbuilding countries and 10-12 sub-top countries. The two biggest countries (Japan and South Korea) have a market share measured in gt in 2002 of 75%, while over the previous 40-year period the two leading countries (Japan and Korea) had a market

share of 58%. From this it is clear that critical mass in shipbuilding pays dividend. Possibly through increased efficiency, purchasing power, short delivery times, standardisation, close knit clusters of shipbuilders and marine equipment manufacturers.

If the ranking of shipbuilding nations in 2002 is compared with the ranking in 1961 (*Table 11*), then the fall and rise of shipbuilding nations becomes apparent. In 1961 Japan was already the leading shipbuilding nation in the world, based on gt, followed by the United Kingdom, Germany, Sweden, France, The Netherlands, USA, Italy and Norway.

	Country	GT
1	Japan	1,719,400
2	UK	1,382,411
3	Germany	1,038,300
4	Sweden	736,500
5	France	543,500
6	Netherlands	467,307
7	USA	402,200
8	Italy	383,400
9	Norway	332,800
10	Denmark	190,500
11	Poland	181,700
12	Spain	145,600
13	Finland	105,900
14	other	2,000,000

Table 11: Shipbuilding nations in 1961 (GT)

2.3. Shipping

World fleet 1911-2002

The world merchant fleet increased from 39 million gt and 22,500 ships >100 gt in 1911 to 585 million gt and 88,700 ships >100 gt in 2002. The continuous growth curve over this 91-year period was only briefly interrupted in the aftermath of the second oil crisis in the early 1980s when many new oil tankers became obsolete overnight and the global economy entered into a severe recession.

In 1961 the world fleet had a capacity of 136 million gt and numbered 37,800 ships over 100 gt. In 2002 it had a capacity of 585 million gt and numbered 88,700 ships. The net increase over this 41-year period was 449 million gt and 50,900 ships. The annual growth rate, in number of ships, was 2.1 percent and in gross tonnage 3.6 percent. That is, average ship size increases 1.5 percent per year. *Figure 4* shows that the world shipbuilding output was almost double these numbers over the same period of time. The difference between the 840 million gt of new ships and the 449 million gt of net fleet capacity increase amounts to 391 million gt. The ships which constitute this volume have been sold for demolition or have been casualties of accidents and thus lost. Based on an average conversion factor of deadweight to gross tonnage of

0.5, the existing demolition data which is published in deadweight capacity, has been compiled and translated into gross tonnage. The reported demolition over the 41-year period amounted to 371 million gt., which is only slightly lower than the theoretical level of demolition, and thus rather accurate.

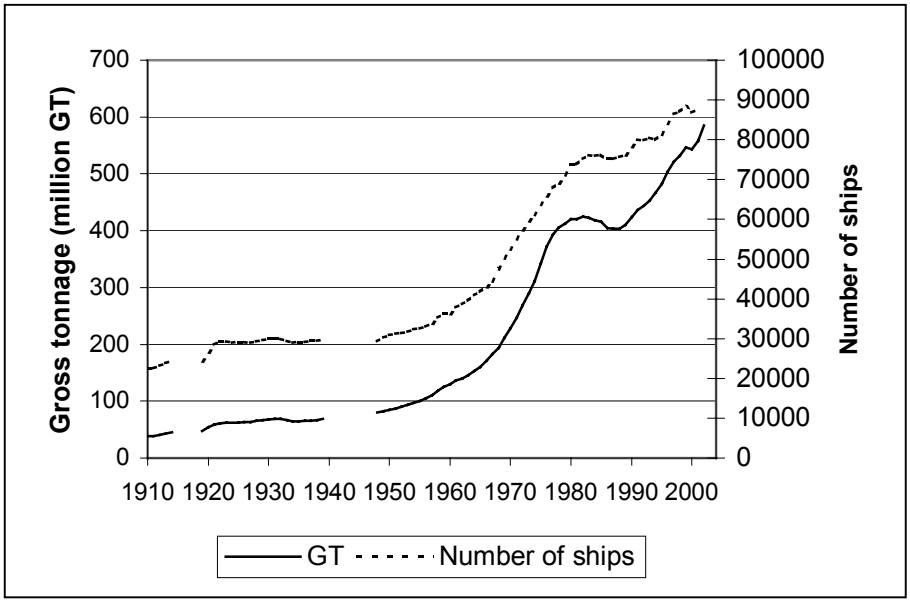

Figure 22: World fleet 1911 – 2002

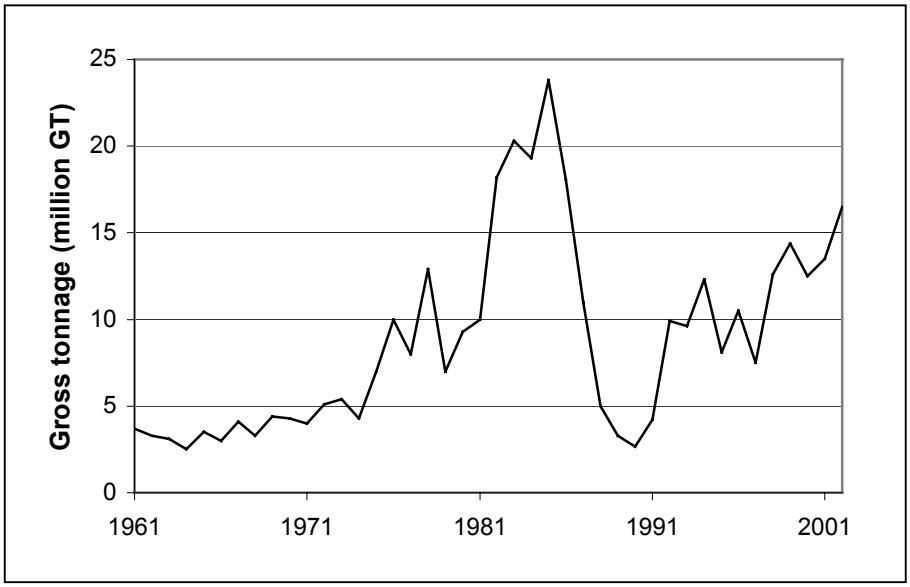

Figure 23: Demolition of ships 1961-2002: 371 million gt

The average level of ship demolition over the period 1961-2002 has been 9 million gt, or approximately 18 million dwt. This illustrates that the replacement market for ships is very substantial. The peaks in ship demolition correlate with the low levels in the freight markets. The extreme demolition levels in the early 1980s have been caused by the 50 percent reduction in demand for oil tanker transport following the second oil crisis in 1979. The high level of demolition in more recent years is partly caused by the ban on single hull tankers following the Exxon Valdez (OPA 90), the Erika and Prestige oil spills.

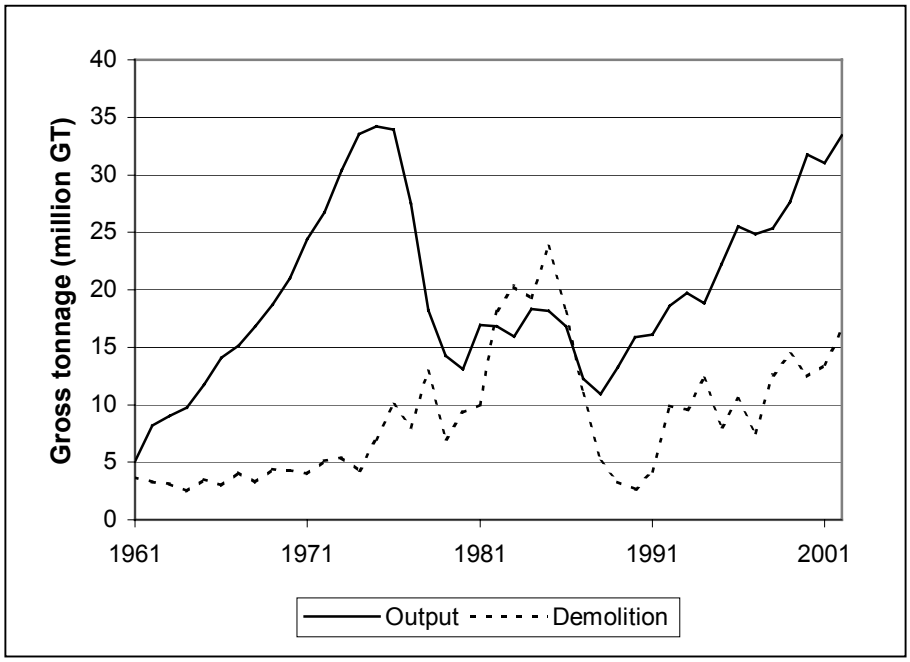

Figure 24: New building versus demolition in gt: 1961-2002

Seaborne trade 1963-2001

The world fleet plays an important role in the global economy; without ships, world trade would be virtually impossible and economic welfare of many countries would be much lower. The possibility to transport many finished goods and commodities at a very low cost, has been one of the drivers behind the growth of the world economy.

Figure 25 shows the volume of seaborne crude oil and oil products over the 38-year period 1963-2001. Over this period 45 billion tonnes of crude oil and 11 billion tonnes of oil products were transported over the world seas. The graph clearly illustrates the decline in oil trade after the second oil crisis in 1979. It took almost 20 years to achieve the 1979 level of seaborne crude oil trade. Oil products volumes steadily increase as a consequence of a continuing concentration of refining capacity in certain regions and countries.

Figure 26 shows the development of seaborne trade of the dry bulk commodities grain, coal and iron ore, as well as the category *other cargo* over the period 1963-2001. The three major bulk commodities show a steady growth rate since 1963. Total seaborne trade over the period 1963-2001 amounted to 134 billion tonnes. *Table 12* shows the composition on the basis of the major commodity categories.

This volume passes, at least, twice through ports all over the world, once as export and once as import. The deep sea seaborne trades thus have generated a terminal handling of 268 billion tonnes, a volume which is growing every year. Most of the countries in the world have invested and still invest heavily in the port facilities to handle the dry bulk, gas liquids, refrigerated cargo or containers. There are virtually no countries with ports that have on the whole not benefited from the growth in seaborne trade. Within a country, some ports may decline, and others may grow, due to natural restrictions like water draught, or closing of refineries and chemical plants.

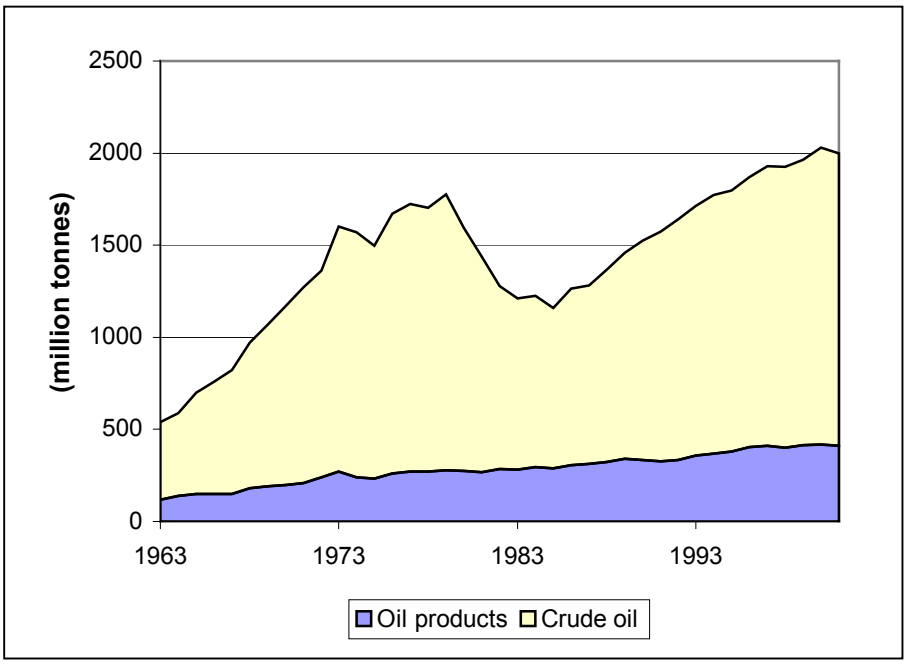

Figure 25: Seaborne trade of crude oil and oil products 1963-2001

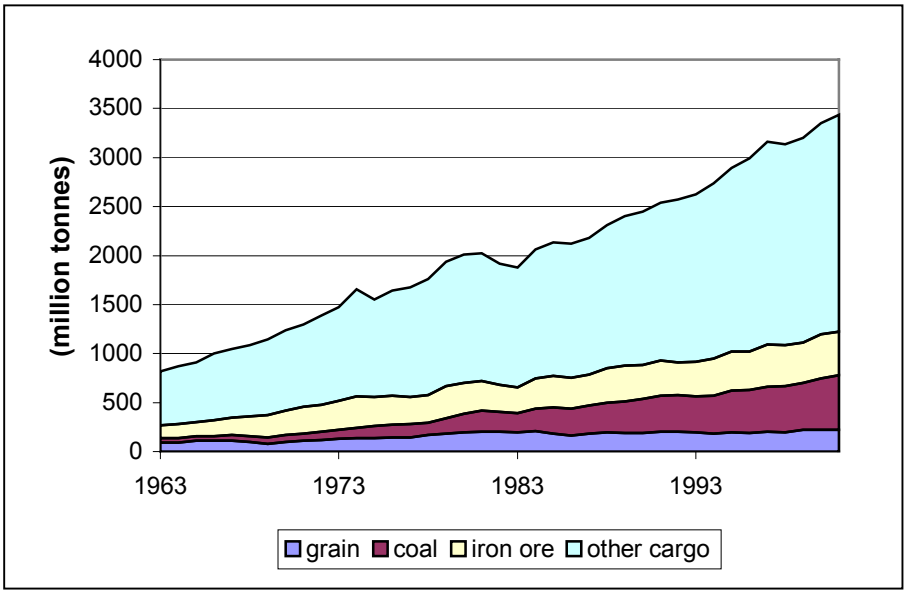

Figure 26: Seaborne trade of bulk and other cargo 1963-2001

	Country	Seaborne trade (Million tonnes)
1	Iron ore	11,901
2	Coal	9,162
3	Grain	6,424
4	Oil products	11,099
5	Crude oil	44,707
6	Other cargo	51,143

Table 12: Composition of total seaborne trade 1963-2001: 134 billion tonnes

The rapid growth of the category *other cargo* is based on the growth of the containerised cargo. This high value cargo is at the basis of a tremendous increase in freight revenue for the shipping sector. *Figure 27* illustrates the increase in freight costs from US$ 23 billion in 1970 to US$ 384 billion in 2000

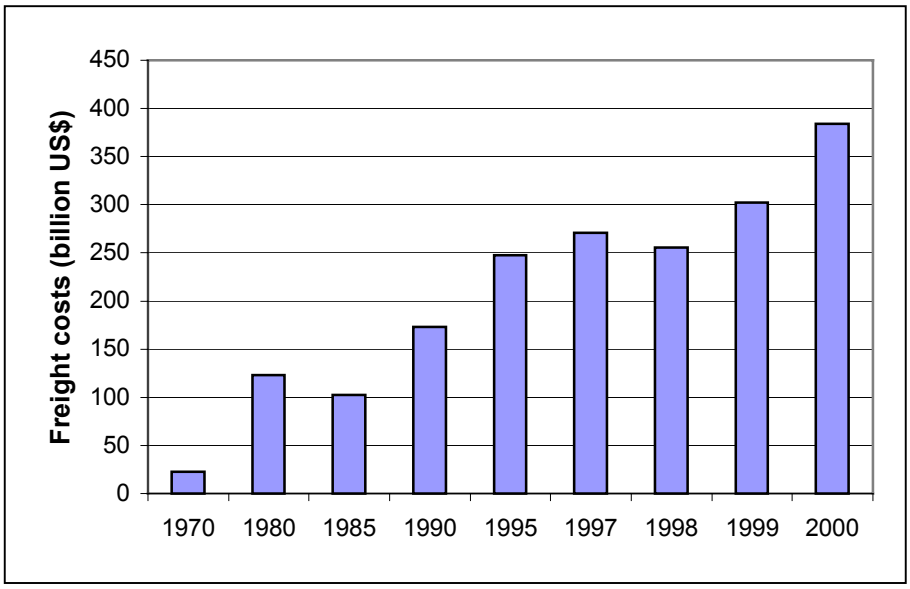

Figure 27: Freight costs of imports 1970-2000

This graph shows that the shipping industry, measured by freight costs, is a major growth industry. The challenge has been for the traditional shipowning countries (flag states) to grow with the market and withstand the strong competition from the new shipping nations. The development of flag states and shipping nations is discussed in the following section.

Flag states 1961-2002

The severe world recession following the second oil crisis triggered a very important change within the shipping world. Shipowners, trying to reduce their costs to the minimum in order to survive, left massively their national flags in order to make use of independent, international registers, often called flags of convenience, which offered a freedom to hire cheap third world crews and to avoid paying corporate and income taxes.

The independent registers had been around since the prohibition in the United States and the World War II, but their growth since the 1980s has been unprecedented. Many new international registers sprung up and lured the shipowners, often with little or no technical and operational infrastructure. The quality standards of shipping slipped during this period and the issues of the substandard ships, shipowners and flag states emerged during these tumultuous 1980s.

Illustration 1: Growth of container shipping [63]

The spectacular growth curve of container shipping demand in million TEU lifts since 1980 is shown in *Figure 28*. The graph underscores the amazing development of the exports from Asia and the relative stagnation of North America and Europe.

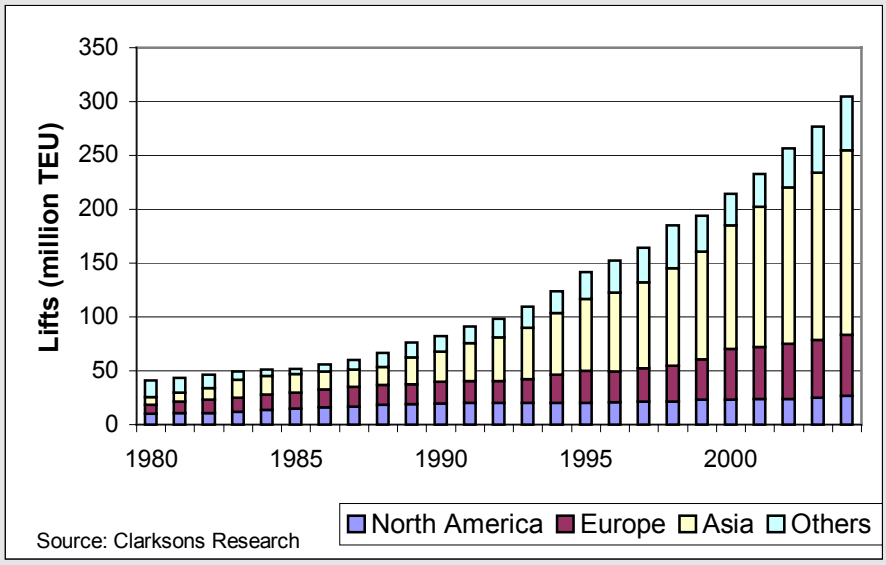

Figure 28: Container shipping demand by region 1980-2004 (2003 & 2004 projection)

The supply of containership capacity since the real take off of container shipping demand in 1991 is shown in *Figure 29*.

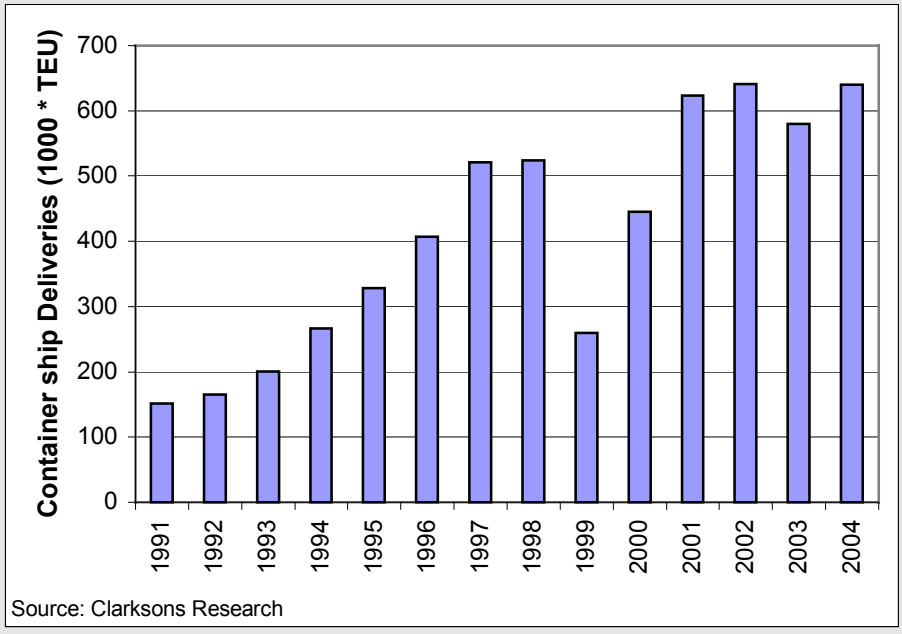

Figure 29: Supply of containership capacity 1991-2004 (2003 & 2004 projection)

The total turnover of the container shipping lines increases with the growth in container volumes from US$78 billion in 1996 to US$106 billion in 2003. This, in spite of a steady decline in the average revenue per TEU, as *Table 13* illustrates.

	Loaded container units (million TEU)	Change % year on year	Average revenue per TEU (US$)	Change % year on year	Gross carrier income (billion US$)	Change % year on year
1996	49.0		1,590		77.9	
1997	53.9	10.0	1,541	-8.7	78.2	0.4
1998	56.2	4.4	1,373	-5.4	77.2	-1.3
1999	61.7	9.7	1,301	-5.2	80.3	4.0
2000	58.6	11.2	1,354	4.0	92.9	15.7
2001	70.6	2.9	1,301	-3.9	91.9	-1.1
2002	77.8	10.2	1,145	-12.0	89.1	-3.0
2003	86.7	11.5	1,224	6.9	106.1	19.1

Source: Drewry

Table 13: Nominal global carrier income (2003 projection)

During the pre-1980s period, the national registers were the norm. In the period thereafter, the international registers took over. At the same time, the rise of the new shipping countries, created a new and often fatal competition for the traditional shipowning nations. These structural changes had many consequences, which will be explored in more detail. In 1948, 82% of the world fleet was registered in only 9 flag states. The USA was the premier flag state, followed by the United Kingdom, and thereafter 7 smaller flag states: Norway, France, the Netherlands, Panama (mostly US shipowners), USSR, Canada and Sweden.

1948	Gross Tonnage (million GT)
USA	29.2
UK	18.0
Norway	4.3
France	2.8
Netherlands	2.7
Panama	2.7
USSR	2.1
Canada	2.0
Sweden	2.0
Other	14.5
Total	**80.3**

1980	Gross Tonnage (million GT)
Liberia	80.3
Japan	41.0
Greece	39.5
UK	27.1
Panama	24.2
Norway	22.0
USSR	23.4
USA	18.5
France	11.9
Italy	11.1
Germany	8.4
Spain	8.1
India	5.9
Netherlands	5.7
Denmark	5.4
Brazil	4.5
Sweden	4.2
Other	78.7
Total	**419.9**

Table 14: Major flag states in 1948 and in 1980

By 1980, 32 years later, the world fleet had grown by 523% and 17 flag states made up 82% of the world fleet. Liberia had become the largest flag state. The register of this African country, was managed out of the USA, and it was, together with the other

international register Panama, home of many American owners. The two major new flag states, Japan and Greece, surpassed the UK, which fleet had stagnated in size in the intermediate period. The spectacular growth of Liberia, Japan, Greece, Panama and Norway, between 1948 and 1980, is shown in *Table 15.*

	1948	1950	1960	1965	1970	1975	1980
Argentina	0.7	0.9	1.0	1.3	1.3	1.4	2.5
Australia	0.5	0.5	0.6	0.7	1.1	1.2	1.6
Belgium	0.4	0.5	0.7	0.8	1.1	1.4	1.8
Brazil	0.7	0.7	1.1	1.3	1.7	2.7	4.5
Canada	2.0	1.9	1.6	1.8	2.4	2.6	3.2
Denmark	1.1	1.3	2.3	2.6	3.3	4.5	5.4
Finland	0.4	0.5	0.7	1.0	1.4	2.0	2.5
France	2.8	3.2	4.8	5.2	6.5	10.7	11.9
Germany	0.0	0.5	4.5	5.3	7.9	8.5	8.4
Greece	1.3	1.3	4.5	7.1	11.0	22.5	39.5
India	0.3	0.4	0.9	1.5	2.4	3.9	5.9
Italy	2.1	2.6	5.1	5.7	7.4	10.1	11.1
Japan	1.0	1.9	6.9	12.0	27.0	39.7	41.0
Netherlands	2.7	3.1	4.9	4.9	5.2	5.7	5.7
Norway	4.3	5.5	11.2	15.6	19.3	26.2	22.0
Poland	0.2	0.2	0.6	1.0	1.6	2.8	3.6
Spain	1.1	1.2	1.8	2.1	3.4	5.4	8.1
Sweden	2.0	2.0	3.7	4.3	4.9	7.5	4.2
USSR	2.1	2.1	3.4	8.2	14.8	19.2	23.4
UK	18.0	18.2	21.1	21.5	25.8	33.2	27.1
USA	29.2	27.5	24.8	21.5	18.5	14.6	18.5
Yugoslavia	0.2	0.2	0.7	1.0	1.5	1.9	2.5
Other	3.6	4.7	7.2	11.8	19.1	35.0	60.9
Liberia	0.8	0.2	11.3	17.5	33.3	65.8	80.3
Panama	2.7	3.4	4.2	4.5	5.6	13.7	24.2
Total	**80.3**	**84.6**	**129.8**	**160.4**	**227.5**	**342.2**	**419.9**

Table 15: Development of major flag states 1948-1980[8] (million CGT)

The world economic recession, which started in 1980 has left its mark in shipping in the decades thereafter. Many ships moved from the traditional national register to the international register, often located on small islands. Besides, many other countries became involved in shipping, sometimes in a big way. In 1948 only 3 percent of the world fleet was registered in an international register (Panama). By 1980 some 17 flag states made up 82% of the world fleet, and there were two major international registers: Liberia and Panama. Under these two independent registers 25 percent of the world fleet was registered or 104.5 million gt. By 1991 the number of international registers had increased dramatically with the Bahamas, Cyprus, and the Norwegian International register. The five registers accounted for 159 million gt, or 36 percent of the world fleet in 1991.

[8] PR China is not represented in this table due to a lack of consistent data

(mln gt)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Argentina	2.4	2.3	2.5	2.4	2.5	2.1	1.9	1.9	1.8	1.9	1.7
Australia	1.8	1.9	2.0	2.2	2.1	2.4	2.4	2.4	2.5	2.5	2.6
Bahamas	0.2	0.4	0.9	3.2	3.9	6.0	9.1	9.0	11.6	13.6	17.5
Belgium	1.9	2.3	2.3	2.4	2.4	2.4	2.3	2.1	2.0	2.0	0.3
Brazil	5.1	5.7	5.8	5.7	6.1	6.2	6.3	6.1	6.1	6.0	5.9
Canada	3.6	3.2	3.4	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.7
China	7.7	8.1	8.7	9.3	10.6	11.6	12.4	12.9	13.5	13.9	14.3
Taiwan	1.9	2.1	2.9	34.0	4.3	4.3	4.5	4.6	5.2	5.8	5.9
Cyprus	1.8	2.1	3.5	6.7	8.2	10.6	15.7	18.4	18.1	18.3	20.3
Denmark	5.0	5.2	5.1	5.2	4.9	4.6	4.9	4.5	5.0	5.2	5.9
Finland	2.4	2.4	2.4	2.2	2.0	1.5	1.1	0.8	0.9	1.1	1.1
France	11.5	10.8	9.9	9.0	8.2	5.9	5.4	4.5	4.4	3.8	4.0
Germany	7.7	7.7	6.9	6.2	6.2	5.6	4.3	3.9	4.0	4.3	6.0
Greece	42.0	40.0	37.5	36.0	31.0	28.4	23.6	22.0	21.3	20.5	22.8
Hong Kong	2.6	3.5	4.4	5.8	6.9	8.2	8.0	7.3	6.2	6.6	5.9
India	6.0	6.2	6.2	6.4	6.6	6.5	6.7	6.2	6.4	6.5	6.5
Italy	10.6	10.4	10.0	9.2	8.8	7.9	7.8	7.2	7.6	8.0	8.1
Japan	40.8	41.6	40.8	40.4	40.0	38.5	35.9	32.1	28.	27.1	26.4
S-Korea	5.1	5.5	6.4	6.8	7.2	7.2	7.2	7.3	7.8	7.8	7.8
Liberia	74.9	70.7	67.6	62.0	58.2	52.6	51.4	49.7	47.9	54.7	52.4
Netherlands	5.5	5.4	5.0	4.6	4.3	4.3	3.9	3.7	3.7	3.8	3.9
Norway	21.7	21.9	19.2	17.7	15.3	9.3	6.4	9.4	15.6	23.4	23.6
Panama	27.7	32.6	34.7	37.2	40.7	41.3	43.3	44.6	47.4	39.3	45.0
Philippines	2.5	2.8	3.0	3.4	4.6	6.9	8.7	9.3	9.4	8.5	8.6
Poland	3.6	3.7	3.7	3.3	3.3	3.5	3.5	3.5	3.4	3.4	3.3
Saudi Arabia	3.1	4.3	5.3	3.9	3.1	3.0	2.7	2.3	2.1	1.7	1.3
Singapore	6.8	7.2	7.0	6.5	6.5	6.3	7.1	7.2	7.3	7.9	8.5
Spain	8.1	8.1	7.5	7.0	6.3	5.4	4.9	4.4	4.0	3.8	3.6
Sweden	4.0	3.8	3.4	3.5	3.2	2.5	2.3	2.1	2.2	2.8	3.2
Turkey	1.7	2.1	2.5	3.1	3.7	3.4	3.3	3.3	3.2	3.7	4.1
USSR	23.5	23.8	24.5	24.5	24.7	25.0	25.2	25.8	25.9	26.7	26.4
UK	25.4	22.5	19.1	15.9	14.3	11.6	8.5	8.26	7.6	6.7	6.6
USA	18.9	19.1	19.4	19.3	19.5	19.9	20.2	20.8	20.6	21.3	20.3
Yugoslavia	2.6	2.5	2.5	2.7	2.7	2.9	3.2	3.5	3.7	3.8	3.3
Other	31.1	32.9	36.9	37.7	40.7	44.0	46.5	48.8	51.4	54.5	56.4
Total	**421.2**	**424.8**	**422.9**	**448.8**	**416.3**	**405**	**403.6**	**402.8**	**410.6**	**423.6**	**436.2**

Table 16: Development of major flag states 1981-1991

Another decade later, in 2002, the basic shift from national registers to independent registers has continued as *Table 17* illustrates. Many new islands have joined the ranks, like Malta, Marshall Islands, St Vincent & Grenadines, Isle of Man, Bermuda, Antigua & Barbuda and many smaller ones like the Pacific island of Vanuatu. The civil war in Liberia caused a flight from this register to a more stable place like Panama, which is by now the largest international register by far. The fleet under these listed independent registers totals 290 million gt, or 52 percent of the world fleet.

Ship register 2002	Million GT
Panama	129.0
Liberia	52.7
Bahamas	35.8
Greece	29.1
Malta	27.5
Cyprus	23.6
Singapore	21.4
Norwegian International	19.4
PR China	16.1
USA	15.8
Hong Kong	14.4
Japan	13.1
Marshall Islands	13.0
Italy	10.3
Russian Federation	10.0
United Kingdom	7.2
St Vincent & Grenadines	7.2
Germany	6.9
Danish International	6.9
India	6.5
South Korea	6.3
Isle of Man	6.2
Bermuda	6.1
Turkey	6.0
Netherlands	5.8
Philippines	5.6
Malaysia	5.5
Antigua & Barbuda	5.0
Iran	4.8
Taiwan	4.6

Source: Lloyd's List, September 2002

Table 17: Top 30 ship registers 2002

Figure 30 shows the increase in registration under international registers in absolute and relative numbers. If the 54-year trend continues in the future, than national registers might become the exception, rather than the rule in shipping.

A structural change happened during the transition period of 1980-1991 in ship management. The independent ship manager evolved to manage many of the ships under the international registers. These were often located in new places, removed from the traditional shipping centres. The International Ship Management Association was formed to set quality standards, as the sub-standard level of many shipping operations was easily blamed on these independent ship managers.

What can and have the national registers done to counteract this development? The Norwegians created a second register, the Norwegian International Register, which has become a quality register. Some national registers, like that of the Netherlands took measures to create a level playing field for the shipowners under its national register. This example, which worked for the Netherlands, has been adopted by most of the other European countries.

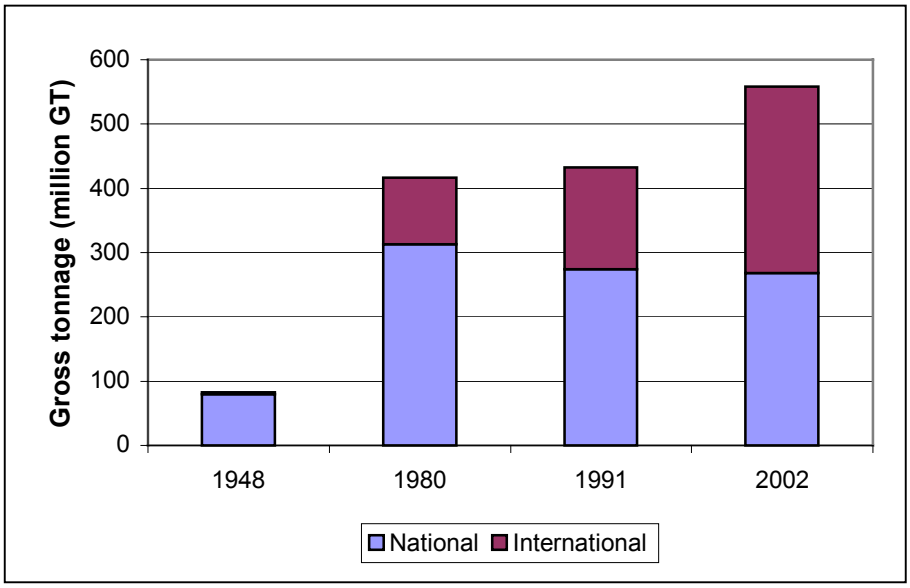

Figure 30: Increase in international registers 1948-2002

Rise and fall of shipping nations 1948-2002

What happened to the 8 major flag states which totalled 80 percent of the world fleet in 1948 by this time? Figure 31 shows the development of these countries over the 43-year period of 1948-1991, in relation to the growth of the world fleet during the same period.

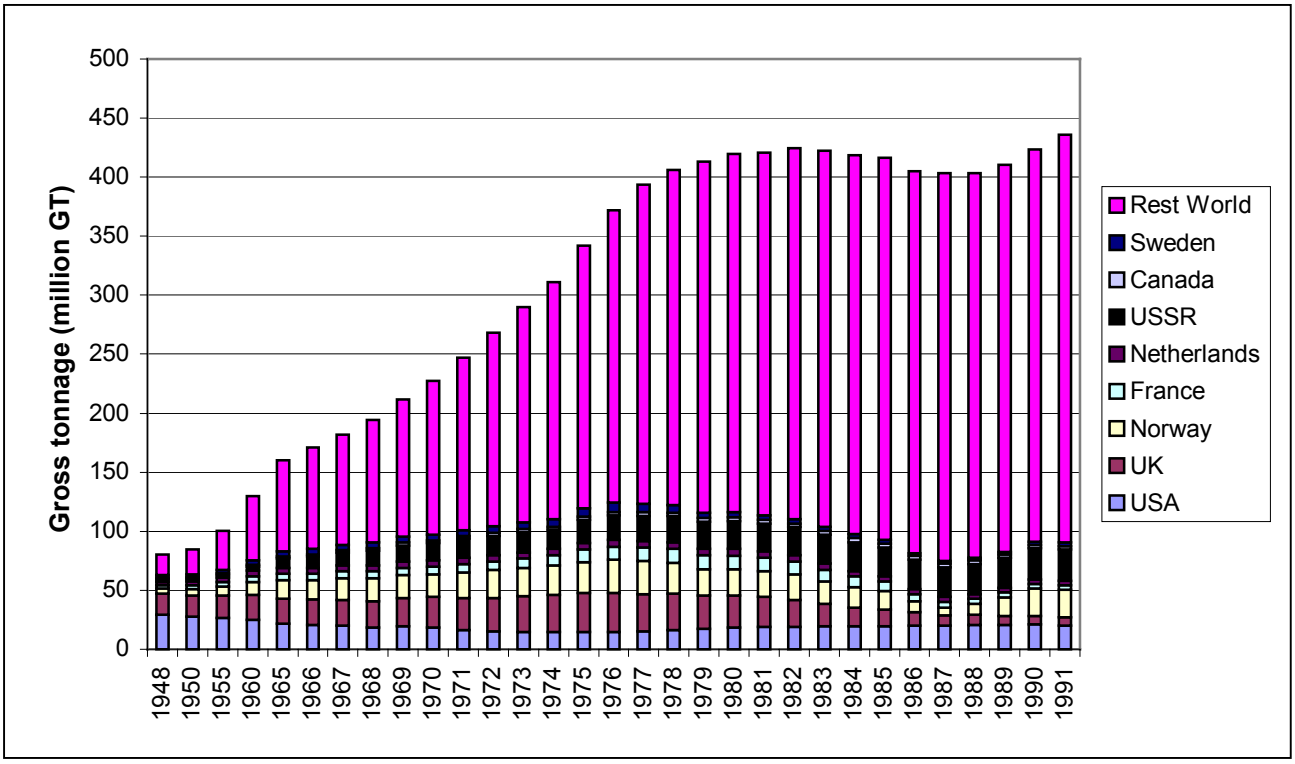

Figure 31: Growth world fleet and 8 major flag states: 1948-1991

There are three striking developments in this graph. The world fleet increased from 80 million gt in 1948 to 436 million gt in 1991, a growth of over 500 percent. The two major flag states in 1948, the USA and UK, were halved by 1991. The USSR was able to expand its fleet and maintain its position during the 43-year period. Norway's register grew aggressively until the second oil crisis, when some of its tanker owners went bankrupt. Special fiscal incentives helped to revive its flag to pre-oil crisis levels. The national flag of France declined as many tankers and bulk carriers were reflaged to the dependent French register on the Kerguelen Islands. The national flag fleet of the Netherlands declined gradually after the second oil crisis, and this lasted until the new shipping policy was introduced by 1996. Since then the fleet has grown with more than 60 percent.

The structural change towards independent registers, has confused the shipowning picture in a formidable way. It has become detective work to reconstruct ownership. *Table 18* shows the top-30 shipowning countries in 2002, based on the country of domicile, while the national flag fleets and foreign flag fleets have been added. Although these data are sometimes not very accurate, its order of magnitude is a good indicator for the rise and fall of shipping nations over the 53-year period of 1948-2001. Please note that the fleets in this table are not measured in gross tonnage, but in deadweight tonnes.

The largest shipowning country in 2002 is Greece, which came almost out of nowhere to world prominence in 50 years; Japan is still a good second, which also developed its fleet since World War II. Norway and the USA grew, but not enough to maintain the top-position. The table shows many rises of new shipping nations, and some of the traditional ones managed to stay in the ranking, but clearly lost out, like France and the Netherlands.

In the near future some countries may challenge the current leaders. For example, the shipping industry of South Korea has launched an ambitious goal not only to dominate world shipbuilding, but also world shipping during the next ten years. In the meantime the Chinese shipowners are growing amazingly fast and they will challenge the current leaders in the next decade, rather than South Korea.

Dwt rank	Country of domicile	National flag (1000 dwt)	Foreign flag (1000 dwt)	Total controlled fleet (1000 dwt)
1	Greece	45,620	99,551	145,171
2	Japan	14,323	86,973	101,295
3	Norway	27,435	33,847	61,283
4	PR China	20,959	19,873	40,832
5	USA	9,393	29,552	38,945
6	Germany	7,258	29,954	37,212
7	Hong Kong	10,962	25,392	36,354
8	South Korea	7,598	17,874	25,473
9	Taiwan	6,724	15,088	21,812
10	UK	7,774	10,450	18,224
11	Denmark	7,980	8,916	16,896
12	Singapore	11,528	5,362	16,890
13	Russia	7,027	6,934	13,970
14	Italy	8,488	4,097	12,585
15	India	9,963	1,444	11,407
16	Saudi Arabia	985	9,136	10,121
17	Turkey	7,815	1,514	9,329
18	Sweden	1,350	6,581	7,932
19	Brazil	5,339	1,848	7,187
20	Belgium	5	7,052	7,056
21	Malaysia	5,199	1,559	6,757
22	Iran	6,144	77	6,221
23	France	2,862	3,126	5,988
24	Switzerland	525	5,173	5,698
25	Netherlands	3,251	2,183	5,434
26	Philippines	4,279	647	4,926
27	Indonesia	3,189	1,161	4,350
28	Spain	1,711	2,015	3,727
29	Canada	843	2,832	3,675
29	Kuwait	3,383	275	3,659
	Total	**249,913**	**440,498**	**690,411**
	Others	23,047	26,785	49,833
	World			**791,345**

Table 18: Top shipowning countries 2002 (by deadweight) [33]

2.4. Other maritime sectors

The rise and fall of shipping and shipbuilding nations has been described in the previous sections. In this section the remaining 9 maritime sectors are briefly discussed. Each individual sector deserves as much attention as shipping and shipbuilding, but that would demand too much space. The 9 sectors are: marine equipment supply, maritime services, ports, inland shipping, dredging, yachting, fisheries, offshore, and naval.

Marine equipment

The important role of shipping as a facilitator of world trade and the global economy has been illustrated in *Chapter 1*. The growth of the demand for shipping services drives the demand for ships and the shipbuilding sector. There is a direct correlation

between the shipbuilding demand and the demand for marine equipment. The future outlook for the European marine equipment sector thus depends on the development of European shipbuilding and the ability of the European companies to export to the strong shipbuilding nations in Asia.

The European marine equipment manufacturers need a substantial home market in order to be able to innovate its products. The impact of a further reduction of European shipbuilding on the marine equipment sector may therefore be dramatic. Not only for the companies, but also for the value creation within the entire maritime cluster. Chapter 3 shows that this sector is the third largest creator of value within the maritime cluster. In other words, the decline of the shipbuilding sector should not only be measured in terms of the value added lost by the shipbuilding sector, but also by the much larger loss of the marine equipment sector.

Maritime services

The growth of world shipping will have a positive effect on the demand for maritime services. The challenge for each individual nation is therefore to obtain or maintain a share of these worldwide shipping activities, and to facilitate the growth of its ports sector. The decline of the shipbuilding sector will negatively impact the maritime services sector, as for example the work of ship's laboratories will decline for the testing of hull forms and propulsion systems. Again, increasing the export of these services may compensate these negative effects, but that will require a major effort.

Ports

Ports grow in tonnage terms, at least twice the rate of seaborne trade, as cargoes have to be loaded and unloaded. In container shipping the transhipment in hub ports increases the volume of containers handled even more. The growth of global shipping is reflected in the port statistics as well. *Table 19* shows the top-50 ports in the world in 2001 in tonnage terms, and their development over the five-year period from 1997-2001.

The top-50 ports in 2001 had a total throughput of 5.4 billion tons, which is equal to world seaborne trade, or approximately 50 percent of world port throughput. The impact of the Asian crisis in the preceding years is responsible for the modest growth rate since 1997. The 7 Japanese ports in this table had a share of 14 percent in 2001, a sharp fall from the 18 percent share in 1997. The 9 Chinese ports had a 21 percent share in 2001, which is a sharp rise from the 17 percent share in 1997. The 9 European ports in the top-50 had a share of 16 percent in 2001, which is slightly below their 1997 share. These developments confirm the rapid expansion of the Asian ports, the decline of Japan and the status quo of the European major ports. At the same time European ports could grow faster than world seaborne trade, as the hundreds of ports on the very long coastline of Europe become part of the rapidly expanding shortsea shipping network. Shortsea shipping is the only transport mode in Europe that can match the growth of road transport, as *Figure 32* illustrates.

(million tonnes)	2001	2000	1999	1998	1997
Rotterdam	314	320	300	307	303
Singapore	313	326	326	312	328
South Louisiana	253	254	245	198	200
Shanghai	221	204	186	164	164
Hong Kong	178	175	169	167	169
Houston	176	159	144	153	150
Chiba	159	169	165	164	173
Nagoya	152	153	133	134	143
Ulsan	150	151	150	148	151
Kwangyang	141	139	131	115	117
Antwerp	130	130	116	120	112
Ningbo	129	115	97	87	82
Guangzhou	128	111	102	78	75
Kaohsiung	128	115	111	98	97
Busan	126	117	108	96	107
Los Angeles	123	114	102	85	88
Inchon	121	120	198	94	123
Yokohama	116	117	115	119	126
Tianjin	114	96	73	68	68
Qinhuangdao	113	94	83	78	79
Qingdao	104	86	73	70	69
Dalian	100	91	85	75	70
Hamburg	93	86	81	76	77
Marseilles	92	94	90	93	94
Richards Bay	91	92	86	86	81

(million tonnes)	2001	2000	1999	1998	1997
Osaka	90	93	85	87	102
Kitakyushu	86	93	90	87	85
Dampier	83	81	83	71	76
Tokyo	82	85	85	88	93
Kobe	80	85	83	100	148
Corpus Christi	79	81	77	81	76
Newcastle	75	74	73	78	77
New York/N.J.	74	65	58	56	52
Vancouver	73	77	71	72	74
Port Hedland	72	73	65	67	70
Tubarao	71	73	69	72	70
Port Kelang	70	65	61	47	56
Hay Pont	69	69	54	51	48
Le Havre	69	67	64	66	60
Amsterdam	68	64	56	56	57
Shenzhen	66	57	50	40	35
Itaqui	64	59	47	52	51
Novorossiysk	57	52	48	47	44
Philadelphia	0	58	56	60	56
Gladstone	54	52	46	43	40
Pohang	52	51	49	48	47
Grimsby/Imm.	51	50	47	48	48
London	51	50	47	48	48
Genoa	50	51	46	45	42
Tees-Hartlepool	50	51	49	51	51

Source: ISL, Shipping Statistics Yearbook 2002

Table 19: Top-50 ports in the world (million tonnes), 2001

Inland shipping

The European Commission published a White Paper titled *European transport policy for 2010: time to decide* from which *Figure 32* is taken. This graph illustates the development of the modal split of the various transport sectors over the 30-year period 1970-2000. The transport production, measured in ton kilometre, increased for road transport and short sea shipping from approximately 500 billion tonne-kilometres in 1970 to 1300 billion tonne-kilometres in 2000. The rail sector declined, while the production of the inland shipping and pipeline sectors grew marginally. The inland shipping sector produced approximately 140 billion tonne-kilometres. The sector has modernised its fleet and increased the productivity during the last decade, helped by a major European scrap-and-build programme (*Illustration 7*). Its role in European transport is important, but its growth has been modest.

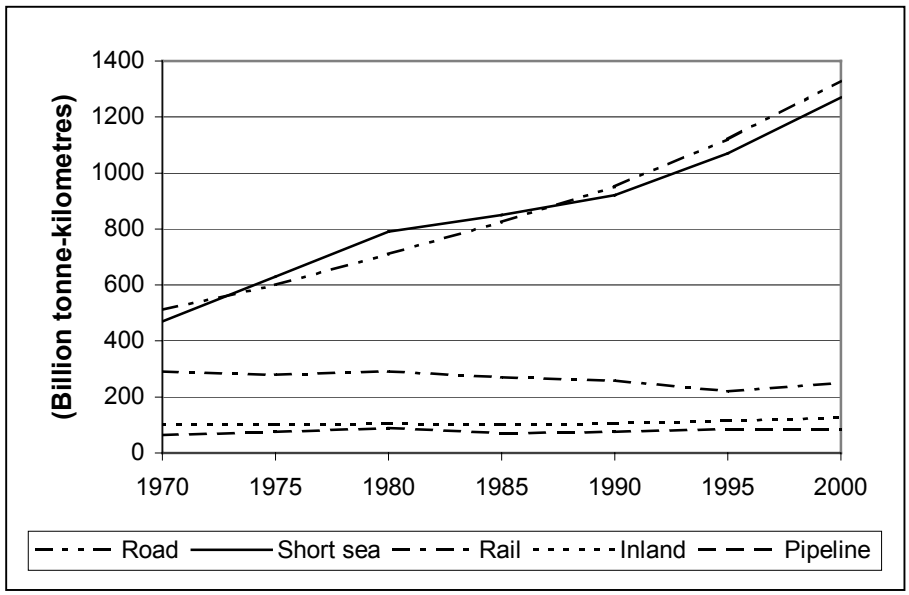

Figure 32: Development of the modal split

Dredging

The expansion of shipping and ports around the world results in a sharp growth of the world dredging sector. This demand is reinforced by land reclamation in coastal areas for the rapidly growing cities around the world, as *Chapter 1* illustrated. Some markets are open for the independent dredging companies, but major markets are still closed, like Japan and the United States. The dredging markets will grow with the continued growth of the global economy, while the breakdown of existing trade barriers may boost demand further in the future.

Yachting

The European yachting sector is prominent in the world. The growth of the yachting sector is not directly linked to other maritime sectors, but rather to the standard of living and the access to recreational waters, either rivers and lakes or coastal waters. The yachting sector in Europe has shown a solid growth over the last years, which is expected to last as long as the economies in Europe continue to grow. Major new yachting markets are in the making in Asia, in particular in China. For example, the province of Shanghai has developed an integral plan for the construction of marina's and the marking of navigable waters. European yacht manufacturers may find there an opportunity to start local production for this huge market that is about to take off.

Fishing

In 1975, the world fishery fleet consisted of almost 19,000 ships with a gross tonnage of 11.3 million. In 2001, the fishery fleet consisted of some 24,000 ships with a gross tonnage of 12.4 million, a modest increase over 26 years since 1975. Russia has the largest fleet of 2,245 ships with a 26 percent share in gross tonnage, followed by the USA, Japan, South Korea, Norway and Spain. The EU-15 plus Norway has in 2001 a total of 3,957 ships and a gross tonnage of 1.8 million or 16.5 percent of the world fishery fleet and 14.6 percent of the world GT. Over-fishing of the seas has become a major problem in European waters and in almost any ocean. This will result probably

in a further reduction of the world fishery fleet. The fisheries sector is therefore not a growth industry of the future.

Offshore

The offshore sector is very diverse, ranging from offshore survey, exploration, production, installation, supply, pipe laying, and so on. The offshore sector is a relatively new sector which started to grow very fast in the aftermath of the world oil crises of the 1970s. It becomes harder to find oil on land and in shallow waters of the seas. The offshore industry, therefore, has moved out to deep waters. Today oil production takes place in water depths of over 2500 metres. This requires many innovations, like the Floating Production, Storage and Offloading (FPSO) platforms. While demand for oil continues to grow, and oil production gets more and more difficult and costly in deep water, the offshore sector will benefit from this and will continue to grow at a higher rate than oil demand itself.

Naval

The worldwide naval fleet consists in the beginning of 2003 of some 5,200 ships, as shown in *Table 20* The current order book for naval vessels is 300 ships, of which 95 patrol ships.

Ship type	Number
Patrol ships	2,500
Coastguard ships	1000
Frigates	700
Minesweepers	600
Corvettes	300
Amphibic ships	100

Table 20: Worldwide naval fleet [30]

In Europe the leading naval exporting countries are Germany and France, while Spain is clearly advancing rapidly. The naval sector is a growth industry, but export is often difficult, as the Netherlands experiences, since it is intimately linked to international politics and financial arrangements at the government level. The potential for European high-tech naval vessels could be further enhanced by a co-ordinated policy at the highest European level.

2.5. Conclusions

The 11 maritime sectors that make up the European maritime cluster have shown different growth paths. Shipbuilding output has dwindled and the very survival of European shipbuilding today is at stake. The fall of shipbuilding may bring down the important marine equipment supply sector, if nothing is done to stop this process, through the creation of a level playing field for the European shipyards.

Shipping is a growth industry, but went through a similar crisis, and found a solution via the flagging out of ships in independent registers which offered low cost and flexibility. Although the further decline of the fleets registered in European registers has been halted through the introduction of a set of measures, like the tonnage tax, a

majority of the European owned ships is still registered in non-European registers. Today approximately 40 percent of the world fleet is controlled by European domiciled owners. The maritime services sector is diverse and some segments will grow with the growth of shipping and seaborne trade, while other segments will decline with the fall in shipbuilding output. The ports sector is a solid performer in the maritime cluster and its future growth is linked to the growth of the European economy, seaborne trade and short sea shipping. Inland shipping plays and important, but modest role in the total modal split in Europe. Its potential can be further enhanced, in particular in the container trades. The future for the dredging sector is bright as Europe has the most advanced dredging sector in the world. Growth depends on the growth of seaborne trade, ports and the access to markets. The yachting sector is a growth industry catering for the consumers and thus dependent upon the growth of the standard of living and the access to navigable waters. Major opportunities for the innovative European yacht building sector will present itself in the economies of Asia, in particular China. The fisheries sector has reached its pinnacle and is likely to decline in the future due to a serious over-fishing problem in many of the oceans. The European fishery fleet will also be affected by this. The offshore sector is a growth industry in particular through the deepwater developments that are taking place. Innovative European companies can benefit in all segments of the complex industry from the growth potential. Finally, the naval sector is also a growth industry and European countries are major players in the naval export markets. Not all countries benefit from these growth opportunities as politics play an important role in securing new building orders.

Apart from the sector perspective as briefly summarised above, the country perspective is also important as the impact of growth and decline of sectors on individual countries may threaten the strength of the entire maritime cluster. For example the fall of the shipbuilding sector in Sweden at the end-1970s had an important impact on the marine equipment supply sector and the maritime services sector. The prominence of the Swedish maritime cluster at that time was hurt by these developments. The current European shipbuilding crisis may have the same effect on other European maritime clusters. The knock-on effect of a decline in one sector onto other sectors, and the consequent loss of value creation, is one of the reasons for the formulation of a European Maritime Cluster Policy, as outlined in *Chapter 9*.

3. EUROPEAN MARITIME CLUSTERS

3.1. Introduction

The European Commission commissioned a study on the European Maritime Cluster from Policy Research and the Institute of Shipping Economics and Logistics (ISL), which was published at the end of 2001 [77]. The purpose of the EC study was to present basic economic data for a wide range of maritime industries in all 15 Member States of the European Union and Norway. The report provides facts, figures and *best estimates*, with regard to the European maritime cluster. The data presented in the report were primarily based on existing aggregated sources. In spite of the consultant's rigorous and systematic data gathering, no data were available for a number of sectors in a number of Member States. The serious lack of data is a major bottleneck in getting political attention for the maritime cluster. Therefore, policy and decision makers should be stimulated by this study to continue the work towards a better and more complete set of data. The results of the study are summarised in the following sections in a somewhat different format than in the original study. Some of the smaller maritime segments have been grouped, for example under the heading *maritime services*. Two countries have been left out, as their maritime activities are too small: Austria and Luxembourg. The base year is 1997 and the figures are in euros.

Please note that the figures in this chapter are based solely on the aforementioned study and that they are not necessarily the correct figures, but rather best estimates.

Defining maritime sectors and the cluster

The Dutch cluster study of 1997-1999 [80] distinguished within the maritime industry eleven sectors, which are schematically presented in the diagram in *Figure 33*.

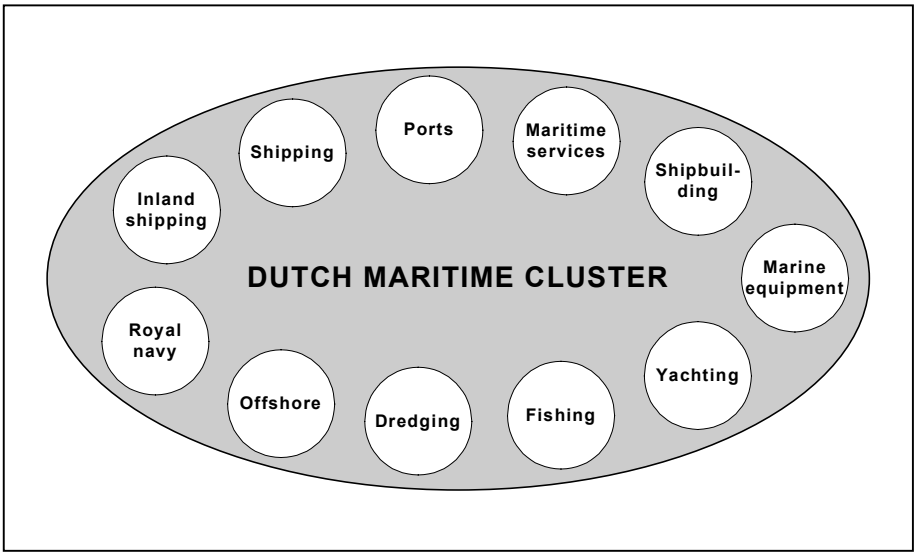

Figure 33: Eleven sectors of the Dutch maritime cluster [80]

The EU study distinguishes between 16 maritime sectors, some of which are non-existent in Europe, like scrapping. Other sectors are part of the offshore sector, like Cable & Submarine Telecom, but have been highlighted for other reasons. In summary, the following regrouping has been made to the 16 EU maritime sectors.

	EU study: 16 sectors		Dutch cluster study: 11 sectors	Allocation of 16 EU sectors to Dutch 11 sectors
1	Shipping	1	Shipping	Shipping
2	Shipbuilding	2	Shipbuilding	Shipbuilding Repair & conversion Naval shipbuilding
3	Repair & conversion	3	Marine equipment	Marine equipment
4	Naval shipbuilding	4	Offshore	Offshore supply Cable& submarine telecom
5	Scrapping	5	Inland shipping	Inland shipping
6	Offshore supply	6	Dredging and marine works	Dredging & maritime works
7	Inland shipping	7	Ports and related services	Ports & related services
8	Dredging & maritime works	8	Navy	-
9	Cable& submarine telecom	9	Maritime services	R&D and education Classification Support services
10	Ports & related services	10	Yachting	Recreational vessels
11	Fishing & aquaculture	11	Fishing	Fishing & aquaculture
12	Recreational vessels			
13	Classification societies			
14	R&D and education			
15	Support services			
16	Equipment manufacturing			

Table 21: Allocation of 16 EU sectors to Dutch 11 sectors

Value added

The economic importance of a sector can be expressed with various parameters. The most relevant one is value added to the economy. The direct value added is the sum of the total personnel cost, depreciation and profit/loss generated by the economic activity. The intermediary purchases of goods and services by the sector, excluding imports, create an indirect economic impact, which is often expressed in a ratio, the multiplier. The sum of direct and indirect value added constitute the total impact of a sector on the economy. Of course other parameters are also relevant, such as production value (turnover), employment and investment. The following paragraphs summarise the 2001 EU report figures [77] for the European maritime cluster for the base-year 1997.

3.2. Value added by the European Maritime Cluster

The total production value of the maritime cluster in 1997 is €159 billion. The direct value added by the maritime cluster in Europe amounts to €70 billion. The break-down by sector is shown in *Figure 34*. The largest sectors are shipping and ports, followed by marine equipment. The direct employment of the maritime cluster amounts to 1.5 million. *Figure 35* shows the division by sector.

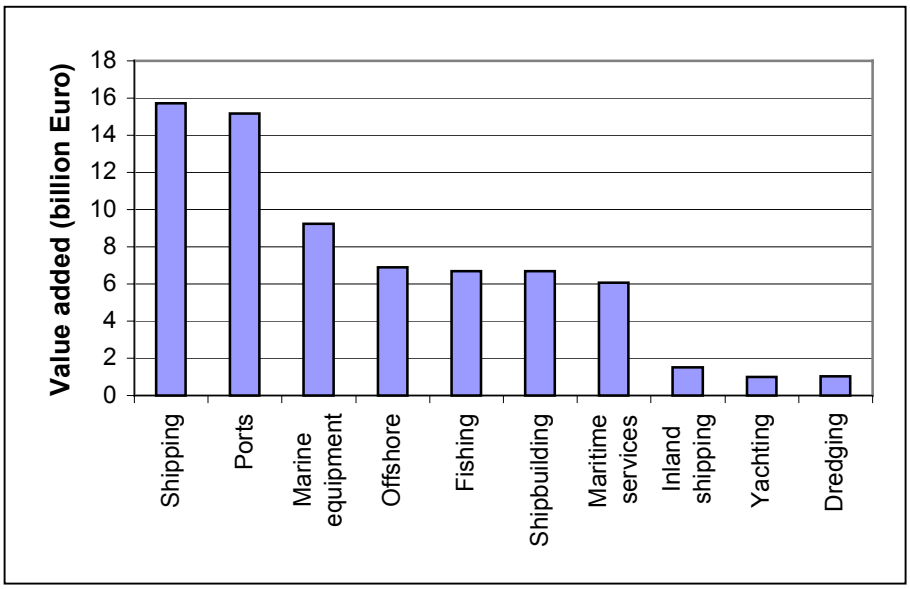

Figure 34: Direct value added by sector, 1997

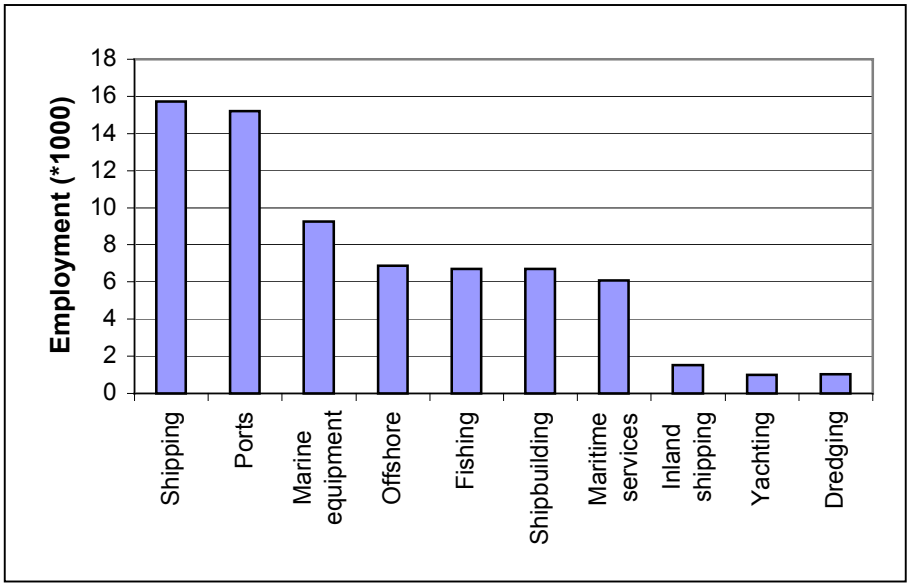

Figure 35: Direct employment by sector, 1997

The maritime cluster generates also important secondary economic effects. This creates additional value added, which amounted in 1997 to €41 billion. The various sectors have a different indirect impact as *Figure 36* illustrates. In the following sections the various sectors will be discussed in more (country) detail.

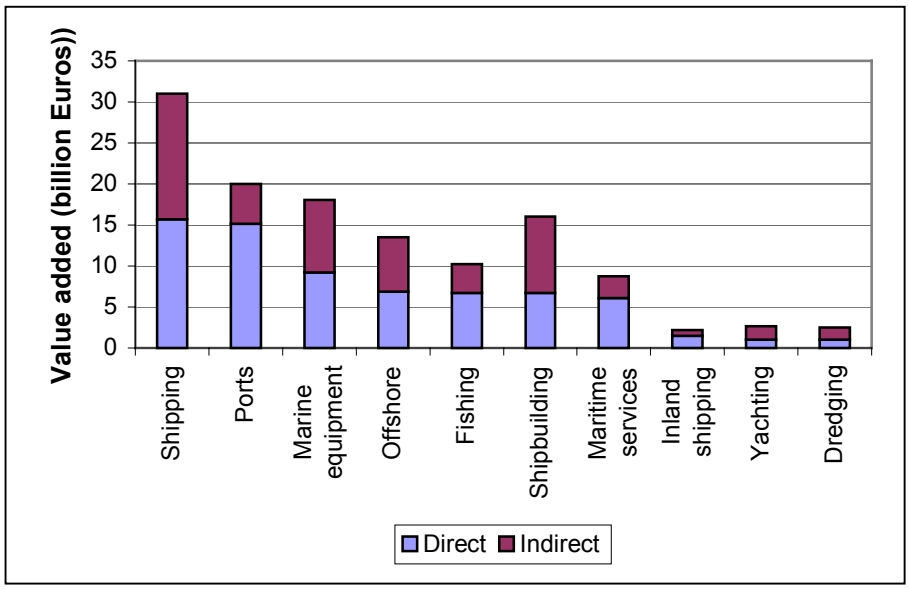

Figure 36: Direct and indirect value added: €111 billion, 1997

3.3. The maritime sectors

Shipping

The direct turnover of the shipping sector in the European countries amounts to €48 billion and is shown in *Figure 37* on a country basis. Shipping is the largest maritime sector in Europe.

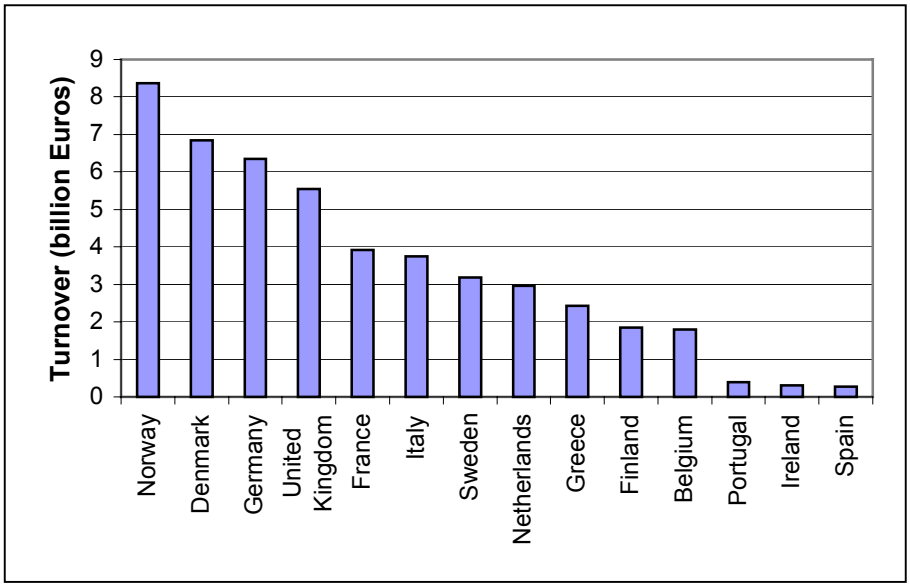

Figure 37: Shipping countries ranked on the basis of turnover

The graph illustrates the structural problems with data. Greece, the largest shipping country in the world, ranks, according to the official statistics, as the 9th largest shipping country in Europe. This is caused by the fact that a large part of the Greek controlled fleet is not registered under the Greek flag and managed outside Greece, and thus it is not part of the official Greek economy. Norway is the largest shipping country on the basis of these data, the Netherlands takes a middle position.

The value added by shipping is, according to the European Commission's cluster study, €15.7 billion. Again this amount probably underestimates the real contribution of Greece. The share of each country is shown in *Figure 38*.

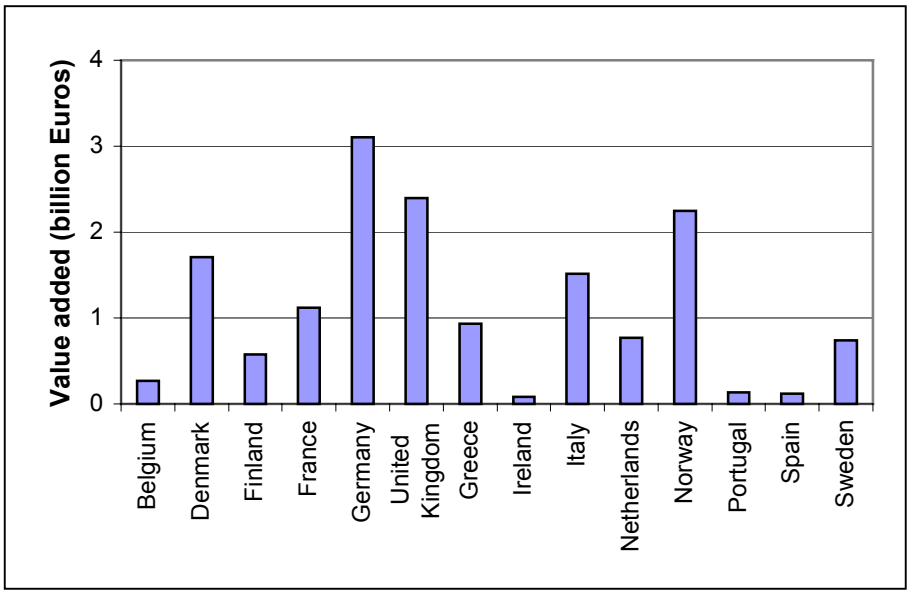

Figure 38: Value added by shipping in European countries

The direct employment associated with European shipping has been calculated at 302,000. The indirect employment from shipping is 305,000, of which 183,000 domestic and 122,000 inter-country. The direct backflow from shipping to the government in the form of taxes and social premiums, amounted to €3.8 billion.

Shipbuilding

In 1997 the European shipyards in the EU and Norway had a turnover of €10.3 billion in new building, €5.7 billion in repair and conversion, and €3.4 in naval shipbuilding. Ship repair and naval shipbuilding are almost as important as ship newbuilding activity for European yards. Germany was the biggest shipbuilding nation.

The direct value added from shipbuilding in 1997 was €3.2 billion, €2.2 billion from repair and conversions and €1.3 billion from naval shipbuilding (incomplete data). These figures stress the importance and labour intensive character of the repair and conversion business for European yards.

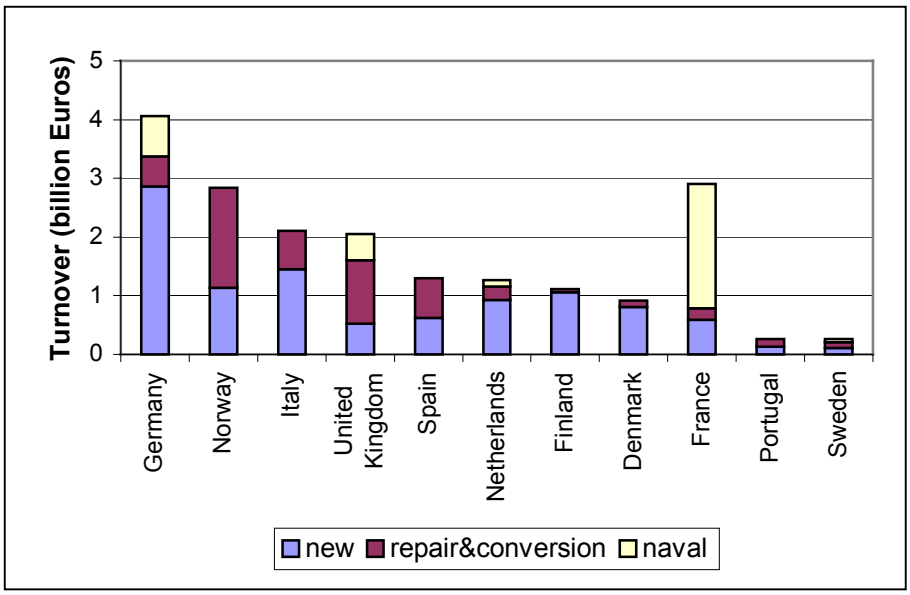

Figure 39: Turnover from shipbuilding and repair, 1997

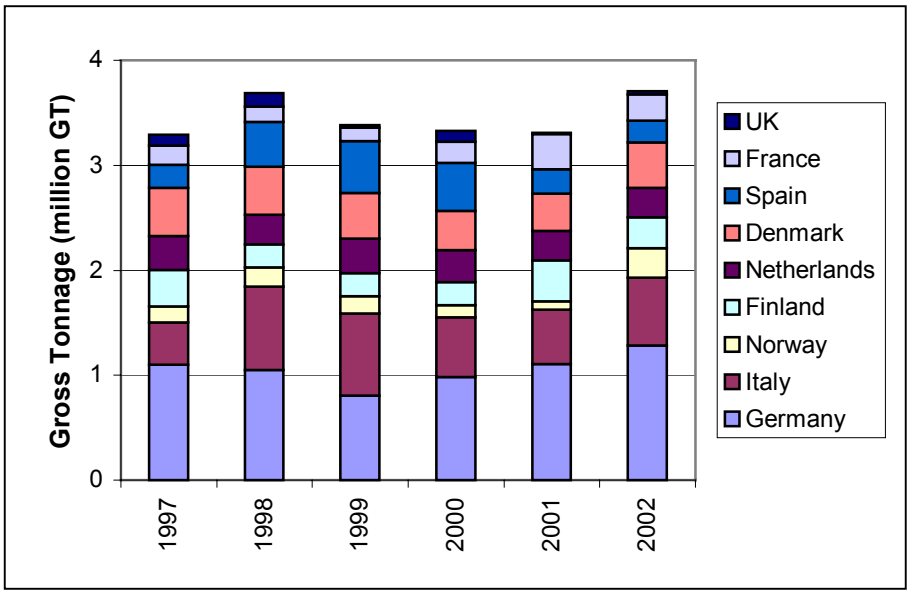

Figure 40: Shipbuilding output 1997-2002

The direct employment from shipbuilding in these countries was 70,000 and from repair and conversion 27,000. In naval shipbuilding 35,000 people were employed. Two shipbuilding nations which may join the EU, Poland and Romania, have large work forces at their yards. These are not included (see *Chapter 2*, *Table 9*). The direct back flow from these activities to the government is €1.4 billion for shipbuilding and €850 million for repair and conversion.

Marine equipment

The European marine equipment sector is substantial and a major exporter. Germany is clearly the largest country, followed by the United Kingdom and Norway as *Figure 41* illustrates. The total turnover in 1997 was €22.4 billion and it is therefore larger than the shipbuilding sector. The direct value added amounts to €9.3 billion, while the direct employment is 262,000. The back flow to the government is €4 billion.

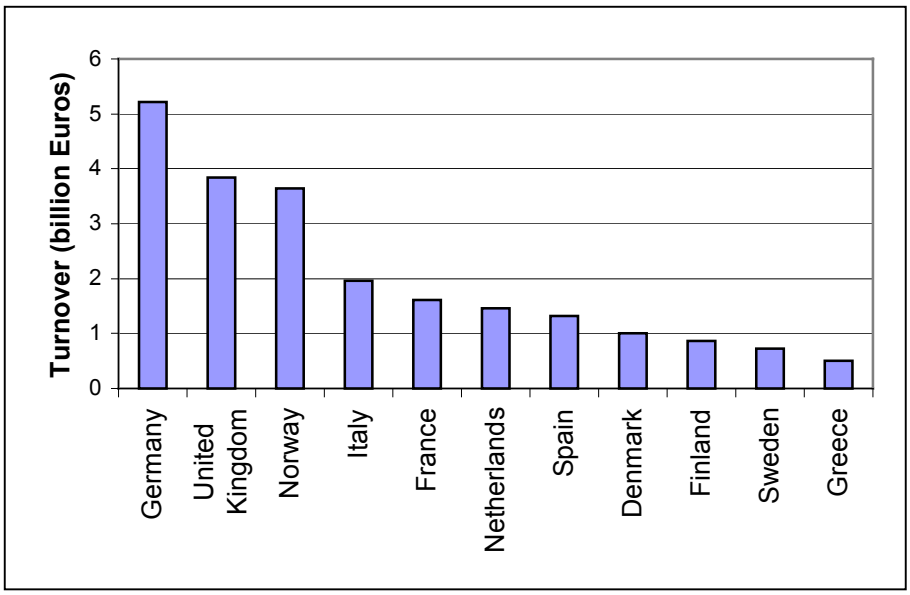

Figure 41: Turnover marine equipment sector, 1997

Ports

Ports and port related services had in 1997 a turnover in Europe of €22.4 billion. Belgium, Italy and the Netherlands are the biggest port countries in Europe as *Figure 42* illustrates.

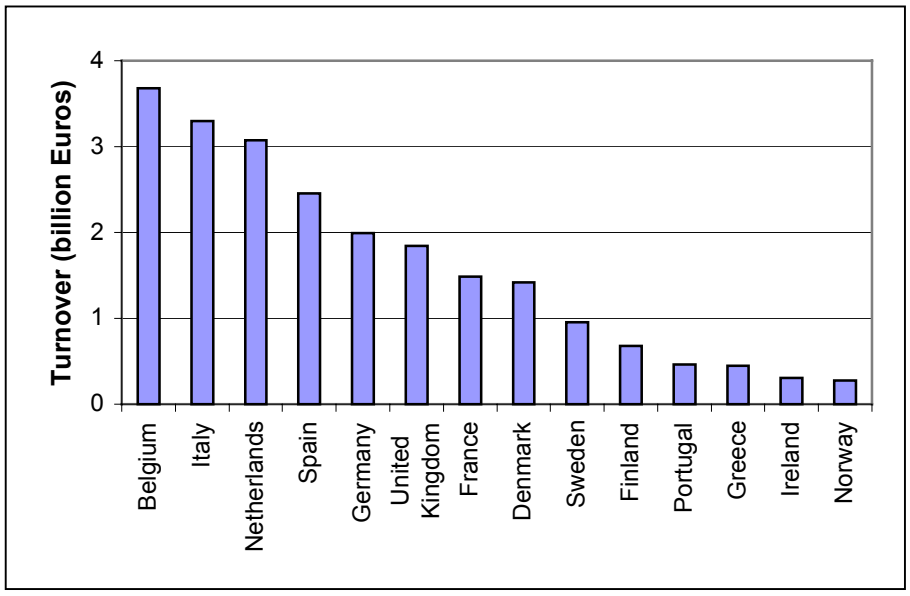

Figure 42: Turnover ports sector, 1997

The value added by the port sector amounted in 1997 to €15.2 billion; it is with the shipping sector the largest creator of value added in Europe. The direct employment in this sector is 217,000 and the back flow to the government is €4.2 billion.

Offshore

The offshore industry had in 1997 a turnover of €16,4 billion and is concentrated in four countries: United Kingdom, France, Norway and the Netherlands. The share of each country is shown in *Figure 43*.

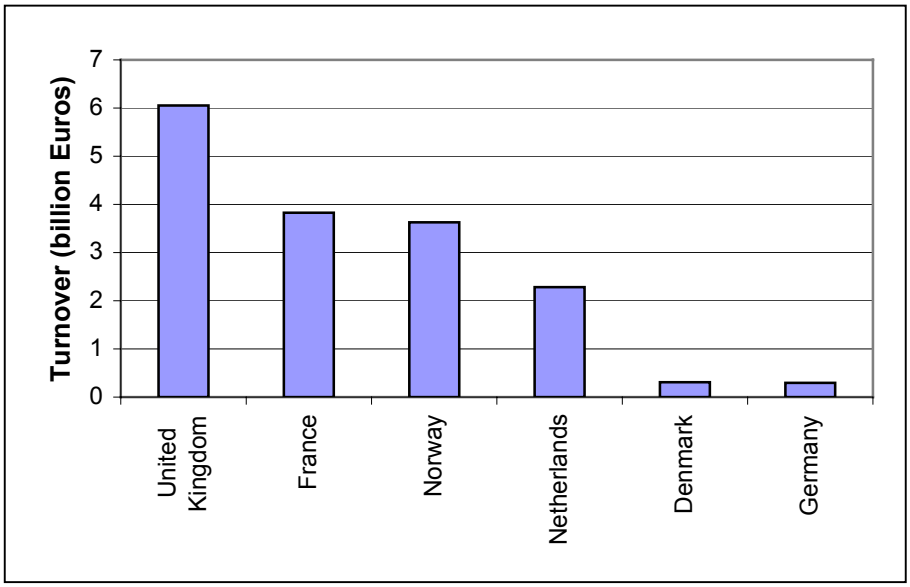

Figure 43: Turnover offshore sector, 1997

The direct value added by the offshore sector is €6,9 billion, while the indirect value added almost equals this amount: €6.4 billion. The direct employment is 144,000 and the indirect employment effect is 133,000. The back flow to the government from this sector is direct €2.7 billion and indirect €1.4 billion.

Inland shipping

The turnover of the inland shipping sector amounts to almost €3 billion. Two countries dominate this sector in Europe, the Netherlands and Germany, which is logical given their position in the Rhine river basin.

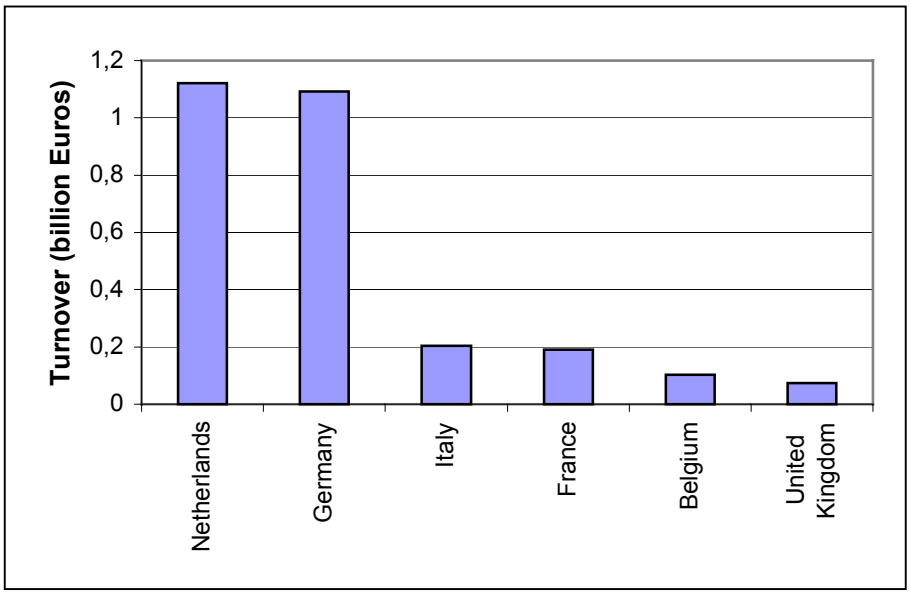

Figure 44: Turnover inland shipping sector, 1997

The direct value added of inland shipping is €1.5 billion, which is modest in comparison with other maritime sectors. The indirect value added amounts to €671

million. The direct employment is 33,000 and the indirect 13,000. The direct backflow to the government is €481 million and indirect another €255 million.

Fisheries

Fishing and aquaculture generate a turnover of €11.7 billion and this sector is thus one of the major sectors in Europe. Four countries have a major fishing sector: Italy, Spain, Norway and France. *Figure 45* shows the turnover of all the countries

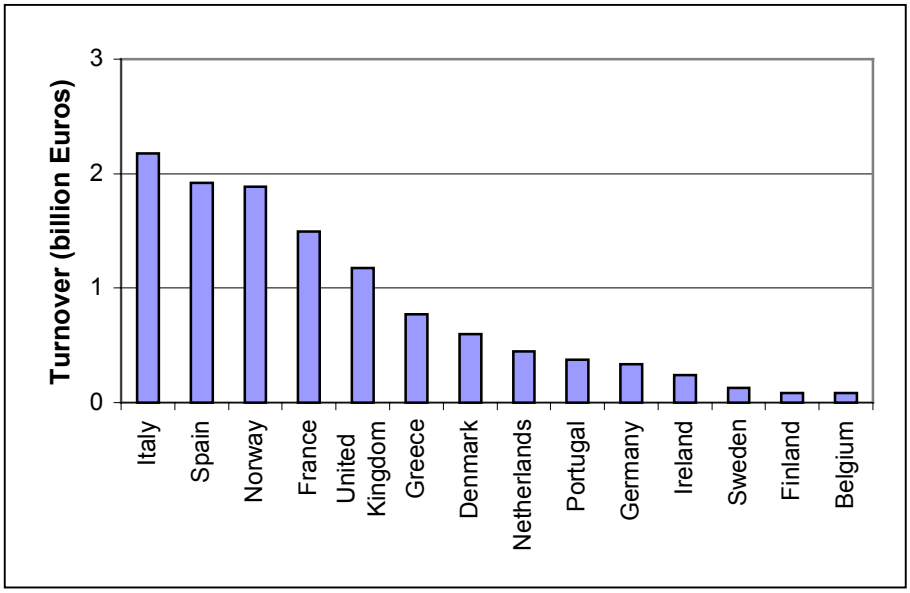

Figure 45: Turnover fishing sector, 1997

The direct value added from these activities is €6.7 billion and the indirect value added is €3.5 billion. The sector employs a very large number of people: 295,000 and the indirect employment which it generates amounts to 70,000. The direct backflow to the government is €2.6 billion and the indirect backflow €700 million.

Dredging

The turnover from dredging in 1997 is €2.9 billion, of which two countries, the Netherlands and Belgium, generate the major share. *Figure 46* shows the turnover of each country.

The direct value added of this sector is €1 billion and the indirect value added is €1.5 billion. The direct employment is 17,000 and the indirect another 30,000. The direct backflow to the government is €370 million and €354 million indirectly.

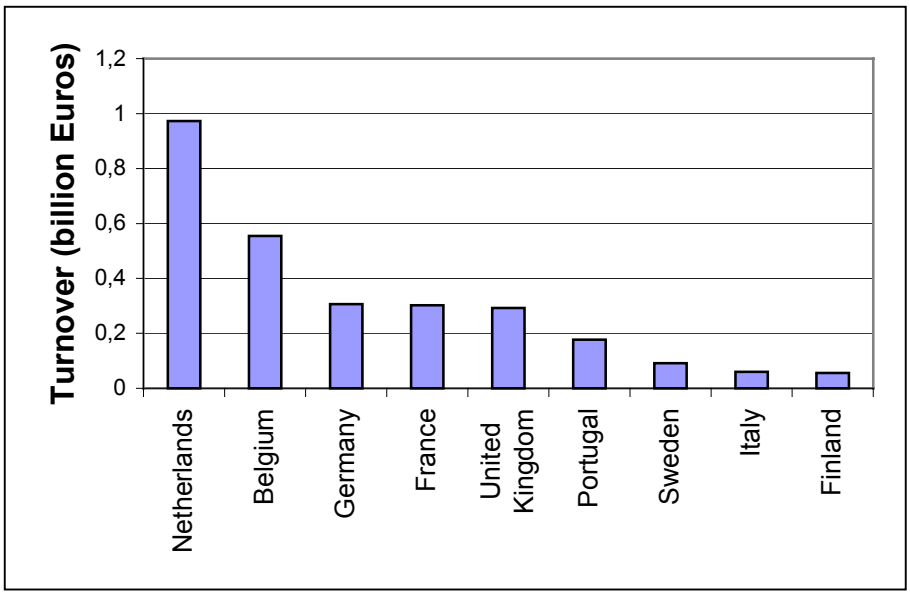

Figure 46: Turnover dredging sector, 1997

Maritime services

The turnover of the maritime services sector in 1997 amounted to €10 billion. *Figure 47* shows the share of each country in the turnover. The United Kingdom has the largest maritime services sector, those of Denmark, France, Germany, Italy, the Netherlands an Norway are also important.

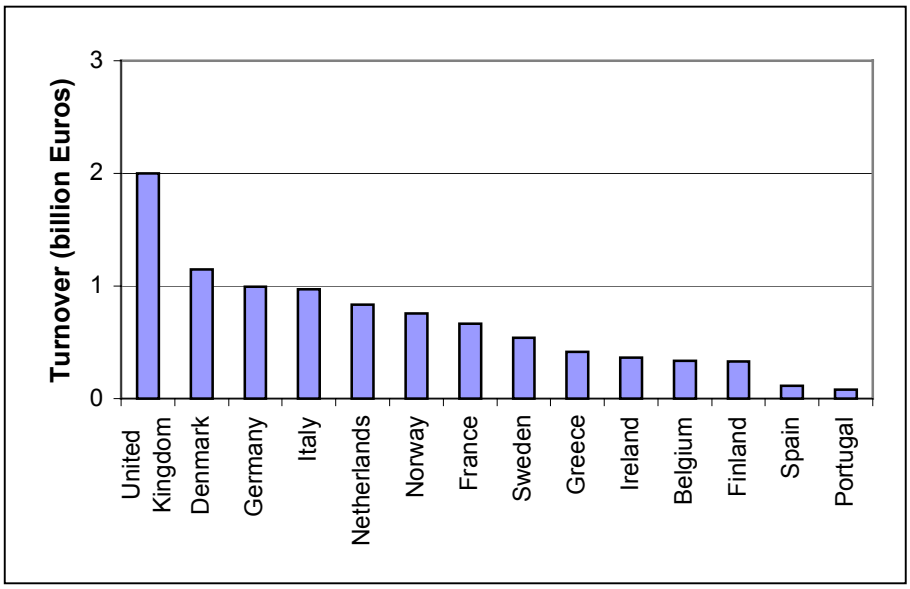

Figure 47: Turnover maritime services sector, 1997

The direct value added of this sector is €6 billion and the indirect value added is €2.6 billion. The direct employment is 109,000 and the indirect another 55,000. The direct backflow to the government is €2.2 billion and €0.7 billion indirectly.

Yachting

The turnover of the yachting sector in 1997 was €3 billion. Three countries dominate this sector: France, United Kingdom, and Italy, while three other countries form the

sub-top: Germany, the Netherlands and Sweden. The turnover of each country is shown in *Figure 48*.

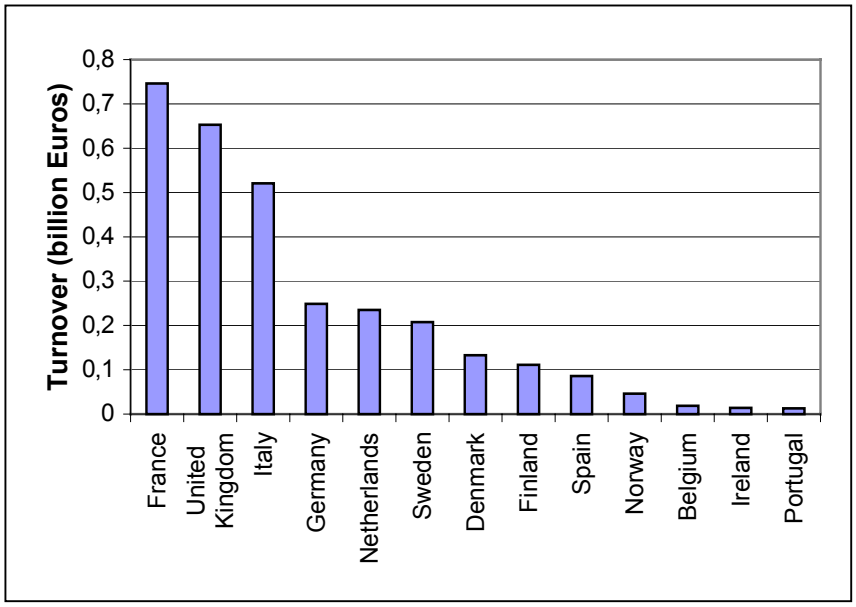

Figure 48: Turnover yachting sector, 1997

The direct value added of this sector is €1 billion and the indirect value added is €1.6 billion. The direct employment is 33,000 and the indirect another 32,000. The direct backflow to the government is €0.5 billion and €0.4 billion indirectly.

3.4. Maritime cluster and the European economy

The study from Policy Research and ISL for the European Commission [77] has highlighted the importance of the maritime cluster for the European economy. The direct value created by the maritime industries is estimated to be €70 billion and constitutes almost 1 percent of Europe's GDP in 1997, with large variations between countries and sectors. The United Kingdom is the country with the highest direct value added from its maritime cluster, followed by Germany, Italy, Norway, the Netherlands, and France. *Figure 49* shows the value added of each country.

Value added is on average 44 percent of the turnover, which amounts to €159 billion in Europe. The direct employment is 1,545,000 persons. An estimated 33% (€23 billion) of the direct value added created by Europe's maritime industries flows back to the national government in the form of taxes and social security contributions. The value added generated by the maritime industries is further used for consumption and investment by the private sector. Private consumption amounted to €16 billion and investment to €19 billion. Only 17% (€12 billion) of the direct value added is spent on goods and services from outside the European Union.

These figures should be considered with some care as the statistical sources are not really suitable to provide accurate data for the maritime cluster. Obtaining the correct statistical data should be one of the priorities for the individual sectors and countries, if the European maritime cluster wishes to have more political influence in Europe.

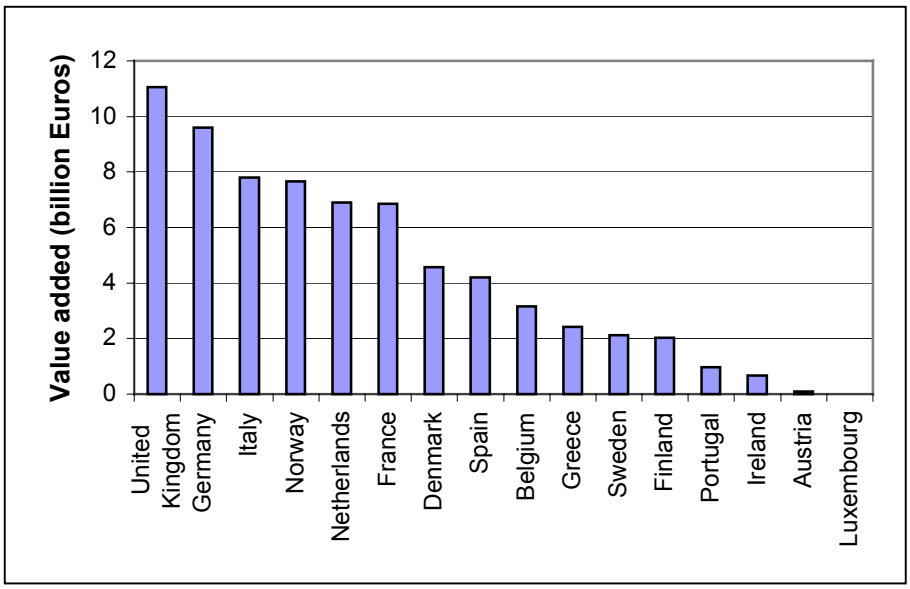

Figure 49: Total direct value added by country, 1997

The description of the European maritime cluster in economic terms does not do justice to a number of strategic aspects which are difficult to express in monetary terms. The population of the EU-15 in 2000 was 375 million and the average GDP per capita was US$ 25,391 (1995-dollars). The EU-15 represents only 6 percent of the world population, but its share in the world economy is substantially higher.

4. BUSINESS CLUSTERS, INNOVATION AND VALUE CREATION

4.1. Introduction

Based on EU-initiated studies, a brief overview of the European maritime industries was presented in the previous chapter. The questions to be answered in this section are: *What is a cluster,* and w*hy are clusters important for value creation and wealth?* This chapter also explores the factors that are supposed to create efficient clusters, and the policies that can be applied in order to stimulate the clustering process. This will lay a theoretical basis for the discussion on the maritime clusters in Norway and the Netherlands. It will also provide a basis for the discussion on the development of conductive public policies in the two countries and in other European countries with a strong maritime industrial cluster. It will also be briefly discussed in what way the European maritime industry may be viewed from a cluster perspective.

Several theoretical perspectives have been applied in the study of clusters. Examples are economic geography, economic theory [53][54][55] and strategy [84]. This book draws on all perspectives but the approach promoted by Porter is of particular importance. However, the characteristics of the shipping context require a pragmatic adaptation of theory and measurements in order to be useful. The contribution of this chapter is to integrate theories, specify the variables and apply the constructs to the maritime clusters.

The next section defines a cluster and provides a categorisation of clusters on different levels of development. Section 4.3 explains why clusters are important and describes the expected outcome of a well-functioning cluster. Section 4.4 discusses the process of emergence, growth and the decline of clusters. In section 4.5 the theories are integrated and a tentative model of the causal relationships of clusters and their effects is created. This model shows how important clusters are to innovation. Since innovation is a key outcome of industrial clusters section 4.6 explores the meaning of the concept and its effect on value creation, competitiveness and growth. Section 4.7 specifies some of the key concepts in the cluster theory. This is necessary in order to analyse the two maritime clusters.

4.2. What is a cluster?

Definition

Originally Porter [84] had a very wide understanding of clusters. He focused on national clusters of vertically and horizontally related firms. Porter [85] limited the definition to geographic concentration of interconnected companies and institutions in a particular field. In the literature the term *regional clusters* has emerged. This represents a further limitation of the cluster concept [104]. In this book, which analyses the maritime cluster in two countries of different size and with different concentration of the maritime industry, a relatively wide definition of cluster is

necessary. For instance, the maritime cluster is viewed, by some researchers, as one of the strongest and most complete clusters in Norway [96][97], but the cluster consists of several relatively small sub-clusters located in different regions in Norway. This implies that a cluster can be located in several regions. However, some of the cluster advantages might be reduced because of a lack of geographical concentration.

The focus on clusters reflects a growing awareness of national and regional resources that stimulate innovation and competitiveness. The development of clusters is by some seen as the only way to overcome the risk of being outperformed in the global economy [57].

Levels of the cluster

Regional clusters are a concentration of *interdependent* firms within the same or adjacent industrial sectors in a small geographical area. Literature distinguishes between three levels of regional clusters [38][36]:

- *Regional innovation networks*: More organised co-operation (agreements) between firms, stimulated by trust, norms and conventions, which encourage firms' innovation activity;
- *Regional innovation systems*: Co-operation also between firms and different organisations for knowledge development and diffusion;
- *Learning regions*: More organised co-operation with a broader set of civil organisations and public authorities that are embedded in social and regional structures.

The three levels represent increased level of co-operation and interdependence. It is assumed that the positive effects of the cluster on innovation and value creation are increasing as the co-operation and interdependency increases. This hierarchy is of special relevance for public policy aimed at developing and strengthening clusters.

Clusters in international industries

In a highly internationalised industry, the degree of clustering will reflect a balance of competitive advantages created by geographical concentration and the costs of international transport and distribution [71]. If the trade-related costs are high there will be many small clusters located close to the markets. If these costs are lower the geographical concentration will be higher. This raises the question in which countries and regions industrial clusters will locate. Based on economic theory Norman [71] argues that the following factors decide in which countries the clusters will develop: historic coincidences, self-fulfilling expectations, comparative advantages (costs of labour, competence of labour, natural resources etc.), and public policy.

Is there a European maritime cluster?

As shown in the previous chapter, there is a large maritime industry in Europe. However, there is little systematic information available concerning the degree of interaction and co-operation between European maritime firms versus the interaction and co-operation between Europe and other parts of the world. There are some signs of

leader firm integration in Europe but still the industry is mainly made up of relatively small companies. The geographical distance between the agglomerations of maritime firms within Europe is also large. In most of the literature it is assumed that clusters are located within one country or in some cases two countries. However, the distances are long within the maritime industry in the Norwegian cluster. Also, the European maritime industry seems to face the same challenges from low-cost countries, mainly in Asia. This has implications for business strategy and public policy. For instance, the question of a more harmonised European policy seems to be more important now. For the business strategy, competition based on cost-leadership will be more and more difficult and the necessity of an innovative differentiation strategy is growing. Also, a larger scale of production is necessary in several segments. Such strategies have strong implications for how the maritime industry organises itself internally and externally. It requires more national and international co-operation and in some cases integration on policy level and on the business level [46]. Some large leader companies have already taken the first step in such a direction, but a more proactive way of acting is probably necessary. As will be substantiated in this book, in spite varied geographic proximity, the maritime sector in Europe might benefit from looking at itself as a *continent wide cluster*. This is a type of cluster not recognised and discussed in previous research.

In order to answer the question of why clusters are important for business development and wealth creation, it is necessary to understand which factors or variables are involved in the cluster processes and how they are related. This is the aim of the following section.

4.3. Why are clusters important?

Companies' localisation decisions will normally reflect a balancing of costs and market access. Many industrial clusters may easily be explained by these factors. A variety of stores in population concentrations are an example of the importance of market access. However, there has been a growing recognition of the importance of the development of competitive advantages within sectors of industry (endogenous competitive advantages) rather than through natural resources or population distribution (exogenous competitive advantages) [99]. The research in this area indicates that the internal dynamics within a particular sector of industry is critical because important positive external economies are created.

Relationships between market size and costs create competitive external economies. For instance companies may reduce costs by locating in an area with good access to production factors. It is also more lucrative for producers of production factors to be in a location with many buyers. In other words, the establishment of firms reduce the cost for new start-ups. This implies that the profitability of businesses depends on how many other companies are located in the area. Also, start-ups in such areas increase the profitability of existing companies. These cluster mechanisms will not be triggered unless there are economies of scale in the production or that there exists other reasons that make the market size important [71].

External economies may not necessarily be connected to market related mechanisms. True external economies are created through direct relationships between companies. When a company buys a production factor of another company, there may be a flow of resources between the companies that are not directly related to the trade. This might be information or knowledge resources that are vital for the learning in the related companies.

There are several different competitive and true externalities that are created in clusters. Different perspectives focus on different factors. Isaksen and Hauge [38] discuss four different schools of thought. In these perspectives factors such as proximity to specialised staff, suppliers, demanding customers, specialised information, a stimulating local rivalry, co-operation/networking, reduced transaction costs and learning are promoted.

According to Scott [107] extensive division of labour, i.e. vertical disintegration of production chains organised in networks of specialised companies, provides flexibility and efficient specialisation and stimulating agglomeration caused by reduced transaction cost in inter-firm relations. The four factors Porter [84][85] states are creating a stimulating business environment are: *factor conditions, demand conditions, strategy, structure and rivalry (competition conditions) and related/supporting industries* (relationships).

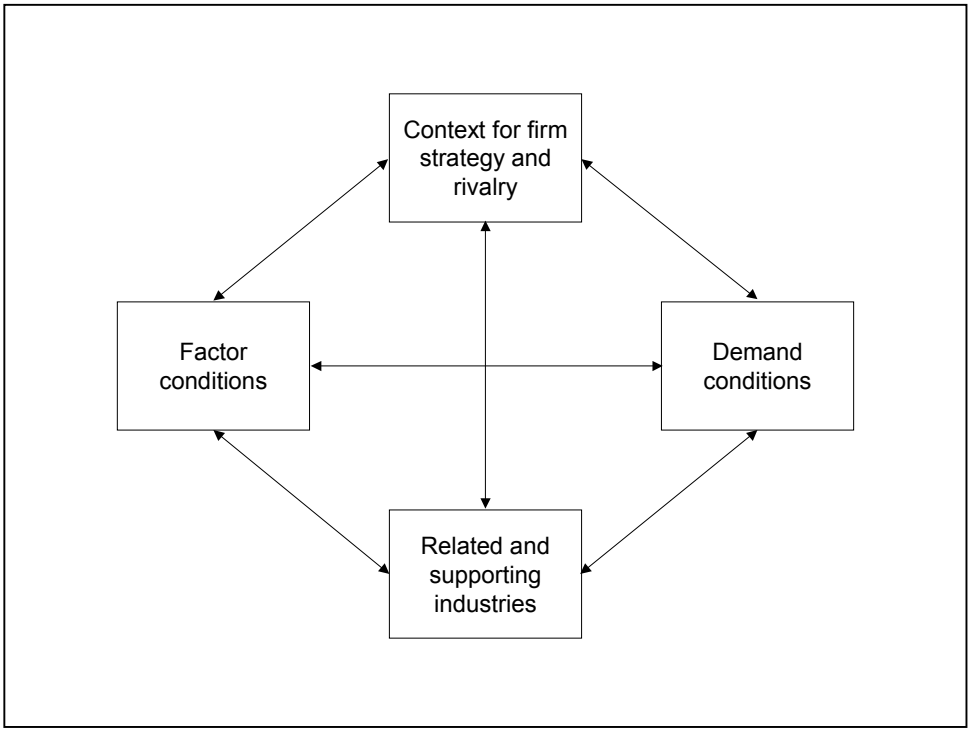

Figure 50: Factors creating a stimulating business environment [84]

The processes of the four factors may create [88]:

- Highly qualified human resources such as scientific, technical, and managerial personnel, strong research infrastructure and information structure and a necessary supply of risk capital (factor conditions);
- A regional environment that stimulate investment in innovation related activities and competition between local rivals (context of firm strategy and rivalry);
- The presence of advanced local suppliers and the presence of clusters instead of isolated businesses (related and supporting industries);
- Sophisticated local customers with needs that anticipate those outside the cluster.

The outcome of the process created by proximity of input factors, local rivalry, local customers and networking is [96]:

- Complementarities in the use of input resources which creates a critical mass of demand necessary for producing the resource;
- Diffusion of knowledge through extensive networking;
- Innovation pressure caused by frequent communication with demanding customers that are not dependent upon one supplier.

The demand conditions can be characterised by *size, growth, and knowledge intensiveness.* Local rivalry is, as pointed out, believed to drive the creative processes in industrial clusters. This includes both competition and co-operation [84]. Companies in a cluster will develop these two processes side by side. They will compete in areas where their products or services *substitute* each other and co-operate in areas where the companies are *complementary* [96]. Such a process will create pressure and opportunities for business development through innovation. The factor conditions include all kinds of production factors such as machinery, human capital, infrastructure, and funding.

The *learning capacity* of firms in clusters is related to proximity of many companies in the same or adjacent industries [67]. In other words, clusters are assumed to shape the networking in a particular way. The knowledge on network characteristics, which promote clusters, is limited. Usually, networking is described by concepts such as size (number of direct and indirect ties), structure (density, redundancy, bridges etc.), the type of resources that flow through the relations, the degree of material or immaterial investments in the relations, and the governance structure (trust, contracts etc.).

All of these factors might be applied, when the advantages of the clusters are explored. A large number of firms in the same or adjacent industry located in one area might increase the number of relations, which again might increase the number and variety of resources available for the firms. This raises the probability that a specific resource can be reached [42][92]. Relationships may, for instance, be created through competition in the same market, production of complementary goods, co-operative production (alliances), development or use of the same technology/R&D, circulation of human

resources (employees, consultants, board members), infrastructure (broad band etc., transportation hubs), and capital (joint ownership, credit institutions) [96].

The proximity of firms might influence the governance of networks by increasing the degree of trust which is assumed to reduce the agency cost in co-operations. Based on this line of reasoning, the cluster increases the intended resource sharing between companies. However, resources are not always intentionally transferred. For example both *contractual or formal knowledge* and *informal, uncompensated knowledge spillovers or leakages* are flowing through ties between businesses [1][9][40][41]. There is a distinction between *know-how* and *information* [52]. Know-how consists of accumulated skills and include a *tacit or non-codifiable dimension* [1]. Information is primarily facts and can be transferred through ordinary communication without loosing its value.

Knowledge is considered to be informal and tacit of nature and difficult to codify, articulate and transfer. Therefore, transference of knowledge/know-how requires long-term and trustful relationships [16]. Transference of information and knowledge/know-how is a requirement for developing a high degree of learning capacity [38]. These lines of arguments provide important reasons for how territorial specific learning capabilities are created in clusters.

The effect of demanding customers, accentuated by Porter [84], creates a self-reinforcing process, because suppliers who meet demanding customers will also have to be tough in their factor markets. In the *new* growth theory [102][103] diffusion of knowledge is regarded as a by-product of market relations and a prerequisite for innovation and growth. Creating a situation where these externalities are maximised is a crucial task for society. Therefore, it is important to stimulate the growth of clusters where diffusion of knowledge presumably is high.

In a new report from the Dutch Maritime Network, de Langen and Nijdam [58] argue that the presence of *leader firms* drives the development of clusters. Leader firms are companies located in a cluster, with a size, market position, knowledge base, and entrepreneurial strength that enable them to contribute to the networks and value chains of the cluster with positive spin-offs for the other companies in the cluster. Porter typifies leader firms in clusters as *anchor companies* which is an adequate maritime metaphor.

4.4. The emergence, growth, and decline of clusters

As products and businesses, clusters often go through a history of emergence, growth, and decline [38]. The birth of clusters may often be traced to specific location factors and historical circumstances. The traditional fisheries and the international trade stimulated by the participation in the Hansa city cluster are important factors in the birth of the maritime cluster both in Norway and the Netherlands. A brief review of the maritime history of the Netherlands and of Norway is given in *Chapter 6* and *Chapter 7*. Clusters may also arise from special and sophisticated local demand, prior existence of supplier and/or related industries, one or two extremely innovative companies, and

coincidences [87]. When the cluster begins to take form, self-reinforcing processes stimulate its growth.

Cluster decline may be caused by cluster internal factors or external factors. As companies, clusters may develop internal rigidity that weakens productivity and innovation. Union inflexibility, over consolidation, mutual understandings, cartels, or other barriers to competition may undermine local rivalry, and therewith the rate of innovation [85]. External factors that may lead to cluster decline are, for example, technological discontinuity and changing buyer needs [85].

Clusters can blossom for decades and in some cases for centuries [85]. The time of vibrancy varies a lot and is difficult to predict. In the EC report *Regional Clusters in Europe*, Isaksen and Hauge provide a six-step model of cluster development [38]. The model includes the following steps:

- Formation of pioneer firms, based on historical circumstances, local knowledge, local customers initiated spin-offs and local rivalry, which is an essential driver of entrepreneurship and innovation [85];
- Development of specialised suppliers, services and manpower, provides increasing external economies and a cumulative process;
- Formation of organisations, such as specialised education, business associations, knowledge organisation etc, serving the cluster firms and supports the learning processes;
- The growth of external economies and local organisations attract outside firms, skilled workers, and fertile grounds for local firms;
- Formation of non-market relationships between persons and organisations, which includes routines and conventions that require proximity. This stimulates the circulation and stimulation of knowledge/innovation;
- Clusters might renew themselves for decades or become a part of a new cluster. However, conformity or rigid specialisation will often lead to a period of decline or even the end of the cluster.

Although individual clusters develop differently, most of them will have a history including the six stages.

4.5. Factors and tentative causal relationships

The discussion above, reveals some important cluster-related variables and some possible effects of clusters. This section discusses the causal relationships involved. This is not a simple task, because the cluster process is of a dynamic nature and the causal relations move in many directions. However, proximity to suppliers, customers, competitors, and relationships between the companies may be viewed as a starting point. The relationships are partly caused by the proximity and the relationships are partly causing companies to locate in the area. This mixture of companies and relationships has certain effects on the business environment. The most important examples are:

- Reduced transaction costs of co-operation, which makes it easier for companies to specialise on a narrow part of the value chain;
- Utilisation of complementarities in the use of input resources, which may:
    - Create scale in production and;
    - Chance of the creation of a critical mass of demand, necessary for producing a particular resource.
- Utilisation of substitution in the use of input resources that create local rivalry;
- Better access to skilled labour;
- Knowledge information diffusion and learning caused by networking;
- Development of coordinating institutions;
- Development of leader firms.

In order to develop a high degree of specialisation, it is necessary to have a diverse set of related companies in the same sector (suppliers/services and competitors). The boundary of the maritime cluster is difficult to determine. Some of the sectors will be of greater importance to the maritime cluster (core sectors) than other sectors. Which sectors should be regarded as core sectors, will probably depend on several factors, for instance, the comparative advantages of the region. The maritime sector might include companies such as shipping companies, shipbuilding, shipping equipment, marine equipment, technical services, financial services, investors, ports, fishing, dredging, inland shipping, yachting, and the navy. The first seven types of companies are often regarded as core sectors and the other as *related marine sectors*. However, in the Netherlands a sector such as dredging is of vital importance for the maritime industry. As will be discussed in *Chapter 8*, a categorisation in demand pull and supply push sectors is necessary to understand the importance of the different maritime sectors.

Reve and Jakobsen [96] regard complementarities, knowledge diffusion and innovation pressure as the outcome of the cluster process. Complementarities, knowledge diffusion, local rivalry, specialisation etc. are important mainly because of their effect on innovation and international competitiveness. In other words, innovation is the primary and most important outcome of clusters in the same or adjacent industrial group. Also, the utilisation of these factors attracts new companies to the cluster, which may trigger that a self-strengthening process may occur in clusters. The formation of industrial clusters provides competitive advantages through continual innovations for the firms that operate within the cluster. This is assumed to increase competitiveness in the national and global market. Lagendijk [57] regards specialisation through clusters as the only chance to outrun the risk of being out competed by other nations.

Within clusters, *leader firms* and *co-ordinating institutions* are created. Leader firms are *naturally* created by the cluster processes, but may also be externally stimulated, for example, by public policy. Also, co-ordinating institutions may be created *naturally* by the cluster process or they may be a result of interventions by the authorities. *Public policy* is an instrument designed by the authorities in order to

stimulate the clustering process. Caused by public policies, clusters often offer better access to public goods.

The discussion on cluster factors and relationships is summarised in the following model (*Figure 51*).

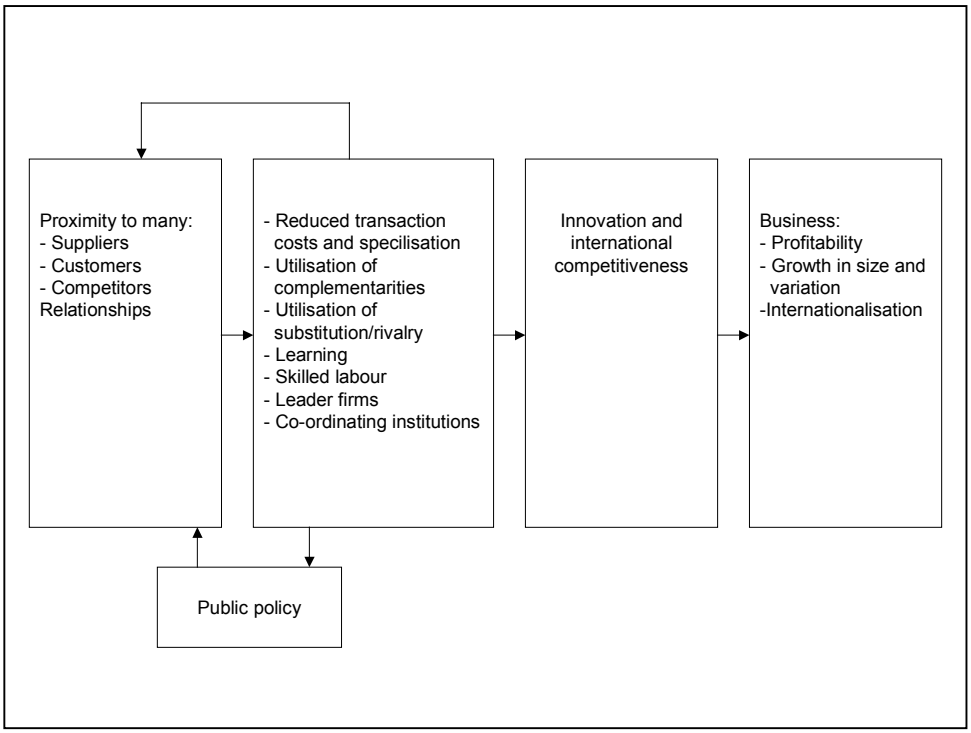

Figure 51: Clusters and their effects

As the discussion reveals, the research does not focus upon the effect of business performance on wealth. The research relies on the assumption that business profitability and growth, create wealth in the society. Clusters are especially important in this process, because they seem to stimulate growth of knowledge intensive production, caused by the learning processes. The benefit of wealth on societies is not only related to economic growth, but also to how the wealth is distributed among the citizens. However, a discussion of this question lies outside the purpose of this book.

An industrial environment needs to have a *solid vertical and horizontal structure* in order to create the stimulating dynamics, i.e. it has to include a variety of suppliers/services, customers and competing businesses. The industrial environment also needs a *critical mass* of related actors. It has to include both *breadth and depth* of organisations. A *complete* cluster, including all kinds of related organisations, provides the companies with important complementary resources. Successful clusters of businesses are characterised by self strengthening growth, driven by competition, co-operation, learning and innovation. The focus on innovation as the primary driver of economic growth is in line with the *new* or endogenous growth theory [102]. Since the crucial outcome of industrial clusters is innovation, it is necessary to have a closer discussion of the concept and its significance for competitiveness.

4.6. Innovation, competitiveness and growth

What is innovation?

Innovation is about what is new, but it does not have to be new in an absolute sense. It is adequate that it is new to the individual organisation [134]. Adjustments of products and administrative procedures to promote the organisational efficiency are not innovations, but variations [48]. Innovation may be classified along several dimensions. First, it can be in the things that the company offers in the market (product or services innovation), in the way that the products or services are produced (process innovation), and in the market segment where the product is offered (market innovation). The first two types of innovations are usually labelled product and process innovations.

Secondly, innovation may be classified by its degree of novelty. A product or process innovation may be a minor, incremental improvement, a change, a radical change, or a transformation [118].

An adjustment in the design of a product is an example of a minor, incremental innovation. A radical change usually has an effect on a particular sector of activity [118]. An example of such an innovation is the LCD computer screen. Sometimes the change is fundamental for the society. The personal computer is an example of such an innovative transformation.

Closely related to the novelty, is the third dimension of innovation, the relative newness of the product or process. Innovation is, as discussed above, about what is new, but it does not have to be new in an absolute sense. It is adequate that it is new to the individual organisation. Therefore, it is relevant to talk about the *newness* of a product or process compared to other organisations. The newness is low when a company starts offering products or services that other companies are already offering, enters markets that other businesses already are operating within, or starts using production methods that other businesses are already offering. The newness is high when a company develops new products, enters markets that no other companies are in, or starts using production methods that no other businesses in the industry are using. It has to be mentioned that it is difficult to think about a radical innovation or a transformation that is not new in an absolute sense.

A fourth dimension of an innovation is whether it represents a *material or immaterial* change. Often innovation is associated with physical or material change, such as a change in a product. However, the change may be immaterial in at least two ways. It may be a change in how a service is conducted or it may be a change in a method or technique such as the development of a management technique (for example balanced score card).

Why is innovation important?

Innovation is *an essential condition of economic progress and a critical element in the competitive struggle of enterprises and of nation states* [25]. The ability to innovate is

one of the most important factors for survival, competitiveness and economic growth in companies [17][133]. Innovation contributes to competitiveness and economic growth in businesses [28]. Porter [85] argues that the *ultimate test of the health or decline of a cluster is its rate of innovation*. There is a clear dependency between the commitment to innovate and profitability in businesses [135]. A study of all groups of industries also shows that innovative businesses are more often doing well than non-innovative businesses [129]. New products constitute a considerable share of the turnover in companies. In a study on innovation in the Norwegian manufacturing industry, Nøs, Sandven, and Smith [72] show that 17% of a firm's turnover comes from products that have changed during the last three years.

The importance of product development has grown considerably the last decades and is now a very important driver of competition in many industries. In certain industries, for instance in car production, biotechnology, consumer and industrial electronics, computer software, and pharmaceuticals, businesses often depend for more than 50 percent of their annual sales on products introduced within the last five years [106]. Also, the product life cycles in certain parts of the electronic and computer industry can be as low as twelve months. An important challenge for companies is therefore, to replace products with new products or better versions of old products faster than the competitors [113]. This means that companies are increasingly competing on time. Companies do not only need to introduce new products, they also need to do it faster than its competitors [113].

The need of efficiency in the innovation process, is also related to first mover advantage. Such an advantage may make it possible to build brand loyalty, yield fruits of early experience, gain control over scarce assets, and create switching costs that bind consumers to the company [60]. In other words, first mover advantages may create a basis of a more sustained competitive advantage [106].

Research reveals a strong correlation between market performance and new products [112]. Products differentiated on quality or other features generate higher return on investment than average and products differentiated on both of these dimensions produce twice the average profit [65]. In order to keep products differentiated over time, a high degree of product innovation is necessary. However, there is also strong evidence that *process innovation* is as critical for many companies, as product innovation. The strength of the Japanese in car production, shipbuilding and consumer electronics is probably strongly related to the quality of the production system [69][118].

The globalisation of markets is an important reason for the pressure on innovation. Since World War II there has been a dramatic reduction in trade barriers between nations and the flow of goods, services, and capital has increased concomitant. This process has created increased global competition. The more competitive markets become, the more complicated it is for businesses to differentiate their product or services on the basis of cost and quality. As a result, product development has become critical to gain a meaningful differentiation.

Product development is of course a challenging process and failure rates are very high. Many innovation efforts never result in a profitable product. In a study it was shown that between 33 percent and 60 percent of all new products that reach the market place fails to generate profit [106]. Also, companies that are slow in the innovation process may find that by the time their products reach the market, the demand has shifted to other products.

There are many examples of technical innovations in shipping that have not provided sustainable competitive advantages. For instance, innovations on vessels have often been quickly imitated. Examples of such imitations are dive/drilling ships, heavy-lift ships, and sheep carriers [128]. Still, technical innovations are important for efficiency of the industry. However, it does not seem to create sustainable advantages. The question is then: *What creates sustainable advantage?* Sustainable competitiveness is gained by integrating core competencies within and between firms. This requires a high degree of relational skill, and may create capabilities that are hard to imitate. Such a process is more likely to happen within a cluster of related businesses.

The request to develop an innovation scoreboard, by the European Council of Ministers meeting in Lisbon, in March 2000, indicates that the challenge of increasing innovation in Europe is a public priority. The goal formulated in Lisbon, is that the EU shall become the most competitive and dynamic knowledge-based economy in the world within the next decade. The Innovation Scoreboard, which is discussed in *Chapter 5*, is an annual assessment of innovation performance in the individual member states of the European Union and in associated states.

4.7. Co-ordinating institutions and public policy

Co-ordinating institutions

Clusters often include organisations that perform joint or co-ordinating activities. In the *Observatory of European SMEs*, an overview of services provided through such organisations, is given in *Table 22*. The same study found that the most important activities are lobbying government, co-ordinating public-private investments and education/training.

Public policy

In the theory of industrial and regional clusters, it is assumed that competition, co-operation, learning and innovation create continuous growth. This is a result of *positive externalities*, which may be defined as unintended by-products of business activity. In other words, external economies are an expression of market failure (imperfection). The individual firms underestimate the value of its own activity, by not considering the fact that their behaviour influences other companies.

R&D	Basic research Applied research
Production	Production Bundling of products and services from several firms
Inputs	Joint purchase of raw material, components Joint puchase/carriying out of service of service functions
Training	Management training Other education or training Technological survey
Marketing and sales	Market research Joint branding Joint selling activities
Logistics	Joint warehousing Joint transportation
Government relations	Lobbying government Co-ordinating public-private investments

Table 22: Examples of areas for co-ordinating institution [38]

The market failure externalities provide the rationale for public intervention aimed at stimulating the agglomeration process. According to the *new* growth theory [103], the crucial economic policy is to establish an institutional environment that supports innovation. Therefore, a key issue for the public sector is to identify the important mechanisms that upgrade clusters (*upgrading mechanisms*). Using the four types or levels of clusters defined above, the aim is to support the transformation of incipient industrial networks to regional clusters, innovation networks, innovation systems and finally learning regions. The learning regions are assumed to produce the highest level of positive externalities and thereof the highest level of innovation.

During the recent years, a variety of public means, aimed at stimulating the cluster process, has been identified and applied. In the analysis of the maritime clusters in Norway and the Netherlands, the aim is to identify and discuss how public policy and specialised cluster organisations might be applied in order to stimulate the growth of the maritime clusters in the two countries. Also, possible implications of this knowledge on European policies towards the maritime industry, will be discussed.

The *Observatory of European SMEs* provides an overview of governmental policies and organisations aimed at stimulating the cluster processes. In this report the governmental policies are divided into six categories (see *Table 23*).

In a survey of 34 regional clusters, financial support of firms' projects, support of physical and knowledge infrastructure, support of education, training and research, and networking programmes were found to be the most important policies [38].

Through the effort of designing policies aimed at stimulating the evolution of clustering, policy makers might be tempted to apply instruments that have been successfully used in other areas (other regions or other industries). However, industries and regions may have different levels of co-operation and interdependencies.

Therefore, public policy aimed at stimulating the cluster development has to be tailored to the situation of the particular region or country.

Firm-oriented support	- Financial support of firms' projects - Advice and consulting for individual firms - Stimulation of leader firm development
Attraction	- Policies to attract outside firms to the cluster
Support infrastructure	- Physical infrastructure - Knowledge infrastructure (education institutions) - Specific service or technology centres - Other cluster organisations
Provide information	- On technology - On general business fields - On market/export fields
Support training, research, recruiting	- Education and training programmes - Research programmes - Mobility schemes
Support collaboration	- Networking and collaboration programmes - Foster social interaction

Table 23: Possible cluster policy instruments (adapted from [38])

Isaksen [36] exemplifies how dissimilar situations call for different policies, by providing examples of policy tools aimed at dealing with different cluster situations. In peripheral regions there is often no innovation system, due to a lack of relevant local actors. There will not be a dynamic promoting cluster development and the collective learning will be low. In such a situation, possible policy instruments are to link firms to relevant knowledge outside the region and attract companies and skilled labours to the area. In other regions there might be relevant companies, but they operate independently. In such a situation relevant policy instruments are to invite the firms to develop regional strategy and create nodes for regional co-operation. It may also be relevant to create a collective vision on the future. An example, is the Leadership 2015 agenda of the leader firms within CESA (European Shipbuilders), which is a powerful tool to create focus and enthusiasm and to obtain resources. In a situation where there is a regional innovation system, but where the system is closed to the outside and the technology is specialised and outdated, it will be necessary to mobilise the community toward reorientation and to open up the networks to the outside. These examples of situations and possible innovation tools are illustrated in *Table 24*.

Type of problem	**Possible policy tools**
Lack of relevant local actors	- Link firms to external resources and acquisition
Lack of regional co-operation and mutual trust	- Develop regional *club goods* and stimulate collaborative efforts - Create a collective vision of the future
Regional industry specialised in outdated technology	- Open up networks towards external actors + local mobilisation

Table 24: Typical innovation system barriers and possible policy instruments [36]

The impact of maritime leader firms

A recent research report from the Dutch Maritime Network shows that the presence of leader firms may create externalities that are important for other companies and the

growth of the cluster [58]. The positive external effects are trade-offs from the behaviour or investments that the leader firms cannot charge a price for.

Investments by leader firms with positive effects for other companies or institutions within a cluster, can be financially in nature, as well as in the form of time and effort, and the use of political effort. In the report from the Dutch Maritime Network, a distinction is made between network-related external effects and cluster-related external effects. The most important external effects from leader firm behaviour within the cluster, are situated in the areas: innovation, internationalisation and labour market. *Figure 52* shows this mechanism schematically.

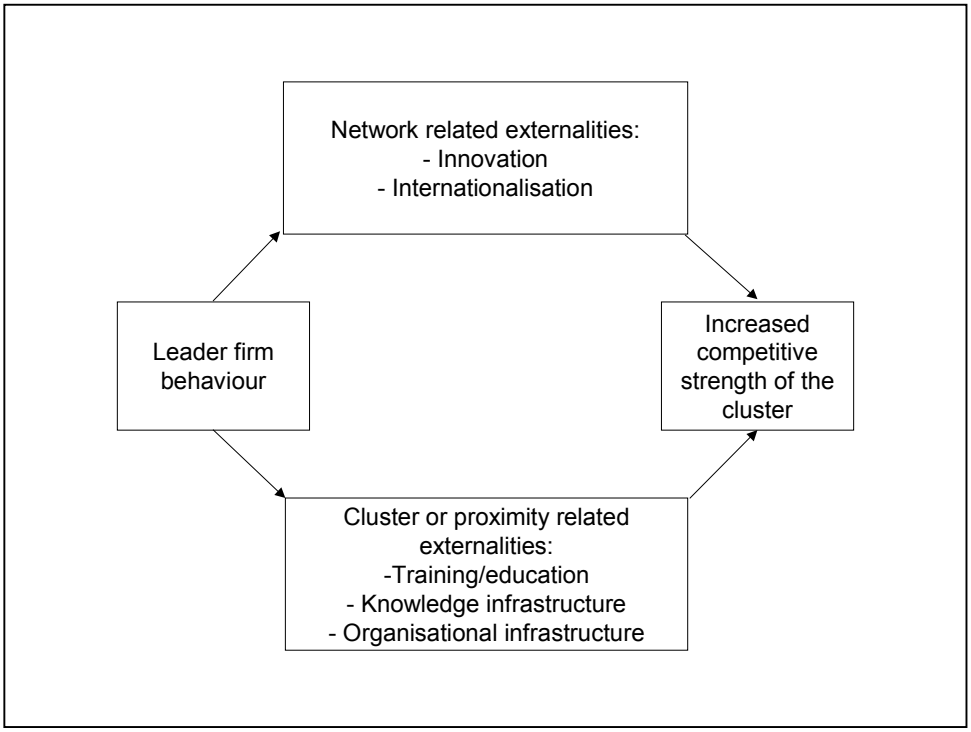

Figure 52: Leader firm behaviour impact on the competitiveness of a cluster

External effects through leader firm behaviour, can be classified into two categories [58]. The first category is an unintended by-product of profitable investments of the leader firm. The second category is a purposeful strategy of the leader firm, with the objective to improve not only the competitive position of the leader firm itself, but of the suppliers as well. The general improvement of the quality of the supplier base, facilitates the leader firms to stay ahead in the international arena.

The referred study points out that leader firms have several positive effects on the Dutch maritime cluster [58]:

- Encourage and enable internationalisation;
- Improving the transfer of knowledge;
- Coordinate production networks;
- Expressing the most sophisticated demands;

- Creating standards/benchmark/strategic guidance;
- Creating and maintaining the organisational infrastructure;
- Improving the skills in the labour market;
- Creating reputation.

For instance, there is a danger that successful regional clusters get over-embedded in their cluster. By too much focus on their direct environment, they may lose sight of the international competition. The comprehensive experience in the international market of the leader firms, through their export position or through the production abroad, may help local firms out on foreign markets. In other words, leader firms may assist SMEs to become more international companies. Also, leader firms may help assure and diffuse knowledge of technologies, markets and competitors from abroad to local firms. The risk of over-embeddedness of local firms can thus be mitigated.

The leader firm has a very dense network and interaction with customers and suppliers. Therefore, they can play an important role in the diffusion process within the cluster. The key competitive factor for almost any cluster is the efficient creation and transfer of knowledge on which innovation is based. Leader firms can play an important role in the translation of new knowledge into improvement or basic innovations of products or processes. The critical mass of leader firms makes them an ideal integrator of knowledge and networks of specialised suppliers. The leader firm also operates as a *coordinator of production* networks which stimulate the competitiveness of the whole network.

Leader firms often place very high demands (specifications) on suppliers to develop new products or services. Through the leader firm's role as *lead user* the supplier is enabled to invest in new technologies that may trigger innovations in the entire value chain. Leader firms are also very well-positioned to *benchmark* the performance of the cluster companies with those in the rest of the world. This may help the cluster companies to focus on external competition and at the same time maintain a healthy level of internal competition.

The quality of the labour market is vital for the development of clusters. The leader firms seem to be important in the process of upgrading the labour market through their investment in their own employees and through the standards they show and communicate through their networks. Also, leader firms often have a high level of outsourcing, which means sharing critical knowledge with suppliers. This helps the suppliers with continuous upgrading of their strategic choices; another element of this *strategic guidance* is the development of knowledge and operational expertise and the diffusion of best practices abroad.

In case the total investment is too large for the leader firm, while a large part of the benefits arise with companies within the cluster, then a *collective action* might be necessary. A well-known example is specialised training and schooling institutions. The leader firm is able to create and maintain the *organisational infrastructure*, for example by taking the initiative and help organise smaller companies. Often leader

firms are involved in sophisticated activities in the national or global forefront. This may well create positive *reputation,* where other companies in the cluster can benefit from.

4.8. Summary

Industrial clusters are very important for regional and national competitiveness and public policy can have an important impact on the development of clusters. The research on cluster development seems to distinguish between five or six *externalities* of the cluster process:

- Reduced transaction costs of co-operation/specialisation (which for instance may create vertical disintegration of production, specialisation and create interorganisational co-operation);
- Utilisation of complementarities in the use of input resources (which may creating scale of production and critical mass of demand necessary for producing a particular resource);
- Utilisation of substitution/local rivalry;
- Better access to skilled, specialised and experienced labour;
- Knowledge diffusion and learning caused by networking;
- Location specific social and cultural factors such as *industrial atmosphere*, conventions, informal rules and habits also stimulate the development of clusters (these factors may or may not be externalities of clusters).

In order to be effective, public policy has to be based on appropriate knowledge. Otherwise the public initiative can be inefficient. The maritime clusters in Europe have a very different structure and size, and the distances between the national clusters are large. Although it is problematic to consider Europe as a maritime cluster, the maritime industry within the continent probably faces the same challenges and the question of a stronger integration of business strategy and public policy should be considered.

The discussion in this chapter shows that the development and effects of clusters on value creation is complex. Also, the structures of the Netherlands, Norway, and other European countries are very different. A full evaluation or benchmarking of clusters is therefore an overwhelming task and requires an extremely high number of data available. When measurements would have been provided for all the variables discussed above, the impression of complexity would have increased. However, the theoretical base is needed in order to select proper performance indicators and to understand the limitation of the variables used as indicators.

In the two countries many investigations into the maritime cluster have been carried out during the previous years. And there is a lot of data available that is not consistent. This is partly caused by dissimilar structure of the industry. Instead of rigorously selecting a particular number of criteria, based on the discussion of factors and the relations between them, an extensive overview of the clusters in the countries will be

provided. Such a strategy makes it possible to further utilise the data already available in each country. However, it is fruitful to make some quantitative comparison between the countries, based on the same measurement. Such a comparison is important for the design of public policies in each country. Therefore, a comparison of the countries as much as the existing data and secondary sources allow, will be provided.

It is difficult to apply policy instruments aimed at stimulating cluster processes. But, it is possible to provide some guidelines for how the problem can be reduced [71]. This study will increase and systemise the available information on maritime clusters. It is naïve to assume that all the necessary information will be provided through research. There will always be uncertainties and information gaps, which may lead the authorities into the hands of special interests. In order to avoid this problem the authorities should choose instruments that are robust towards lack of information. This can be done by designing instruments targeted towards the sources of the market failure. Such a policy is important to implement, regardless of the cluster. Another possibility is to design instruments that reveal how strongly private actors believe in the cluster effects. As argued, it is appropriate for public sector to do something in order to stimulate the cluster processes. However, according to the theory of asymmetric information, it should be less than one would have done with the necessary information available.

5. BENCHMARKING AND MARITIME CLUSTER EVALUATION

5.1. Benchmarking as an evaluation methodology

The benchmarking methodology is often used as an evaluation tool for businesses. Its origin lays with a technique called *reverse engineering*, which tends to be a technical, engineering based approach to product comparisons, including tear-down and evaluation of technical product characteristics. This analytical process provides valuable clues to make improvement innovations in design or production. The first generation was followed in the mid-seventies by a second generation benchmarking methodology: *competitive benchmarking*. This method moved beyond product-oriented comparisons to include comparisons of processes of those of competitors, in particular the enablers of best practices

The third generation of benchmarking - *process benchmarking* - developed during the early eighties, as more quality leaders recognised that they could learn more easily from companies outside their industry than from competitive studies. Companies that compete have natural boundaries beyond which they will not share process information. These boundaries and restrictions do not apply for companies that are not direct competitors. Process benchmarking is thus based on the development of analogies between the business processes at two or more companies.

The fourth generation of benchmarking is *strategic benchmarking*. This is the systematic process for evaluating alternatives, implementing strategies, and improving performance by understanding and adapting successful strategies from external partners who participate in an ongoing business alliance. Strategic benchmarking differs from process benchmarking in terms of the scope and depth of commitment among the sharing companies.

The fifth generation of benchmarking is *global benchmarking*. This methodology includes the cross-cultural differences of international business practices and the implications for business improvement adapted to the local conditions, constraints and opportunities. *Figure 53* shows the evolution of benchmarking methodologies.

The graph triggers the question whether there might be a sixth generation benchmarking method specifically for global clusters of companies. Before this question is answered, two essential concepts of every benchmark study will be briefly discussed. These are: *performance gaps and enablers*. The standard benchmark process consists of four steps:

- Planning the benchmark project and defining the performance indicators;
- Collecting the necessary data;
- Analysing the data for performance gaps and enablers;
- Improving by adapting process enablers.

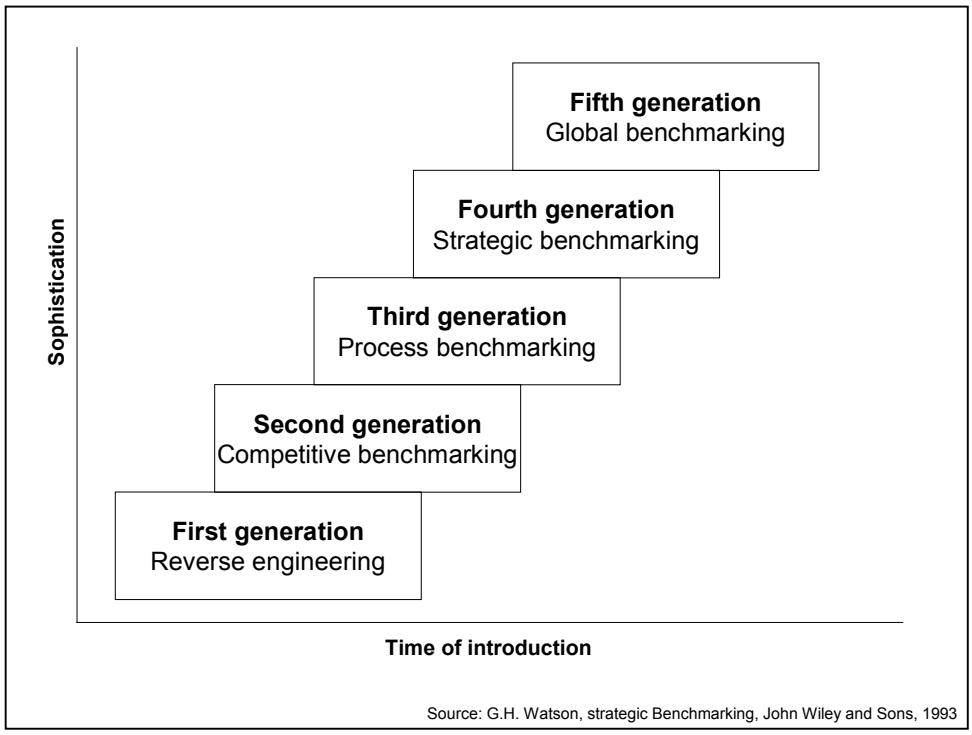

Figure 53: Benchmarking as a developing science [124]

Defining the benchmark performance criteria, which are critical success factors in the business processes is the first step in the project. When these performance criteria are measured within the company and compared to those of a competitor, a performance gap can be formulated. The closing of the gap is the first objective of the benchmark project. The key-factors that are able to achieve this objective are called process enablers. The benchmarking project is successfully concluded when not only the performance gap is closed, but when the competition is outperformed.

The benchmark approach is applied world-wide by thousands of companies. It is, however, usually restricted to single companies, or a group of companies in the same industry. The Global Maritime Benchmarking (GMB) project [39] carried out by, *The Centre of Value Creation* of the *Norwegian School of Management (BI),* is quite different in nature as it concerns many clusters of industries, with thousands of companies, and often with quite a different make-up of sectors in different countries. Therefore, it is not self-evident that the existing benchmark methodology can be applied one-on-one to the maritime clusters in various countries. The structure of the maritime clusters are often very different and the companies within each sector differ widely. It is, therefore, doubtful that the standard global benchmark methodology as it has evolved over the last years is an adequate tool. There are four main elements in the GMB project according to the proposal:

- *Competitiveness.* The study should enable the assessment and ranking of the current and future competitiveness of different countries as a location for maritime companies. More specifically, the study should identify the advantages and disadvantages of these countries in relation to the regulatory

environment, e.g taxation levels and trade barriers, and cluster characteristics, like infrastructure, competition, co-operation, and linkages.

- *Forecasts.* Based on the insights into the strengths and weaknesses of the maritime industries in the various countries, forecasts should be made as to opportunities or threats for maritime cluster growth.

- *Policy recommendations.* Best practices should be defined and communicated to public and private sectors, which should lead to an improved performance and competitiveness.

- *Location decision.* Norwegian companies should be aware of the best maritime countries when they take location decisions. The study should create this insight.

The theoretical framework of the GMB methodology is shown in *Figure 54.* The model includes a large number of variables of which data are not available through secondary statistical sources. A study based on this ambitious model requires not only qualitative data, but especially accurate quantitative data in sufficient numbers. Therefore, the researchers have carried out a quantitative study based on an internet survey of key companies in the maritime cluster in five countries. Five hundred companies responded to the electronic questionnaire.

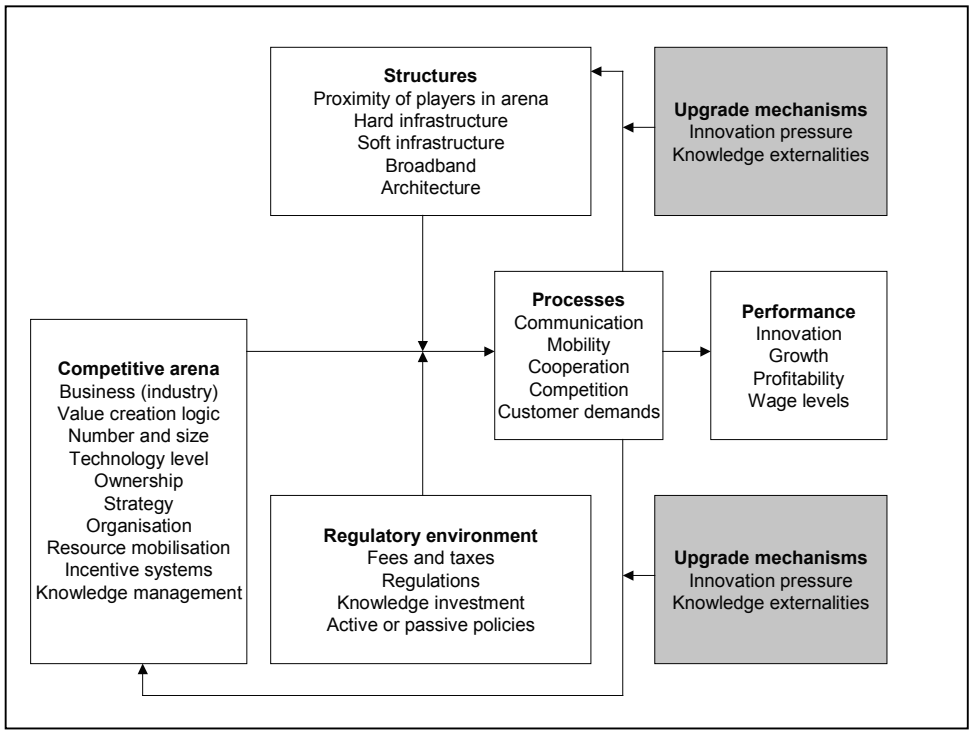

Figure 54: Theoretical framework for the GMB project [39]

In this study a different approach is followed, in order to benchmark the maritime cluster. It is largely based on qualitative analysis, as quantitative responses are difficult

if not impossible to come by, as the GMB study and a similar EU Marine Equipment Benchmark Study some years ago illustrate.

Maritime clusters are large and complex, while the structure may differ widely. The maritime cluster in the Netherlands consists of 11 sectors (11,500 companies, *Chapter 6*) and the Norwegian maritime cluster consists of 13 sectors (see *Chapter 7*). It is therefore a rather enormous effort to compile data for a representative study of the maritime sectors in a country, let alone five countries. Besides, some of the vital elements of a cluster are hard to quantify. A more in-depth analysis is often required in order to understand the causal relationships and its dynamics of the many variables. A superficial quantitative approach might suggest exactitude, but in fact may overlook the essential elements of cluster dynamics. Another important aspect, when comparing maritime clusters is the absence of a level playing field in many countries, which is definitely the case in the shipbuilding sector. This creates serious problems when comparing clusters and their viability.

These arguments do not imply that the GMB initiative is not meaningful. However, the question should be asked about the representativeness of a sample of 500 companies which responded to the questionnaire. This only constitutes possibly 1-2 percent of the number of companies in the five countries that were under study. The benchmarking methodology used in this study tries to combine the existing quantitative information with the qualitative insights of the maritime sectors and the driving forces in the global markets. In order to illustrate the problems associated with a limited sample of companies, the EU Marine Equipment Benchmark study is discussed.

5.2. EU marine equipment benchmark study

Every benchmark study depends on the availability of data. Without reliable and representative data, a benchmark project ends up with incomplete results. The European Maritime Cluster study, which has been discussed in *Chapter 3*, spends a whole chapter on the problems with data, on sectors and within countries. Most of the data for this study was not available in public sources, or not the right kind of information. Then a major effort has to be undertaken to obtain the co-operation of the companies. Even if these are willing, they often have not organised their management information and administrative systems in such a way that they are able to provide the answers quickly. A good and sobering example of the problems encountered in a competitive benchmarking project is the European Commission's study *Competitiveness and Benchmarking in the Field of Marine Equipment* [6].

The performance of the marine equipment industry is relevant for the competitiveness of the shipbuilding industry in Europe. Consequently, it is of strategic interest for European industrial policies as pursued by the European Commission to maintain a viable and dynamic marine equipment industry. The objective of the study commissioned by the EU was to better understand the conditions within the European marine equipment industry, to analyse its global position and to derive appropriate policy instruments. The study has four modules:

- Marine equipment industry structure and statistical market evaluation;
- Marine equipment market forecast for merchant shipbuilding 2000-2005;
- Benchmarking methods and tools for the maritime sector;
- Marine supply chain management.

All the modules contain very interesting material, analyses and recommendations, but in the framework of the current study, only the benchmark related issues will be discussed briefly.

The objective of the module *Benchmarking methods and tools for the maritime sector* was to develop industry-specific indicators for performance and competitiveness and to develop a benchmarking methodology and to test the methodology on a European level.

The first step was to classify marine equipment products, according to the strategic purchasing view of shipyards. Nineteen groups of equipment were distinguished, such as Group 1: propulsion, power generating systems, or Group 4: instrumentation, control and navigation systems. Besides, performance indicators have been defined to measure the competitiveness and performance of marine suppliers. The methodology for the benchmarking approach has been taken from the *European Network of Advanced Performance Systems (ENAPS)*. This methodology is briefly summarised below[18].

To define what performance actually is, and to measure the performance, ENAPS required the definition of business processes. The starting point was the development of a business model incorporating all functions of a manufacturing enterprise including the recycling of products. With links to customer, supplier, recycler and service provider various functions within a manufacturing system were described. The outcome was the ENAPS business processes as product development, obtaining customer commitment, order fulfilment and customer services as well as the secondary processes, the support and the evolution process.

Based on the typology and the process model in the last step the indicators are to be defined. So finally the benchmarking case is initiated by the use of performance indicators. These indicators measure the effectiveness and/or efficiency of a part or whole of the process or function against the given performance level coming from the database. All together, there are 95 indicators based on 111 measures. Each client has the choice of how many and by which anonymity he likes to hand in his measures.

Performance indicators fulfil two purposes: First, constantly monitoring the status within the company and second, in the meaning of ENAPS indicating the current performance against others: Above average, acceptable or below the average initiating in both cases improvement activities if necessary. The Performance Measurement Cube (see *Figure 56*) summarises the dimensions of measurement (as cost, quality or environment), the categories according to the typology and the measurement levels. ENAPS recognised three different, but linked levels:

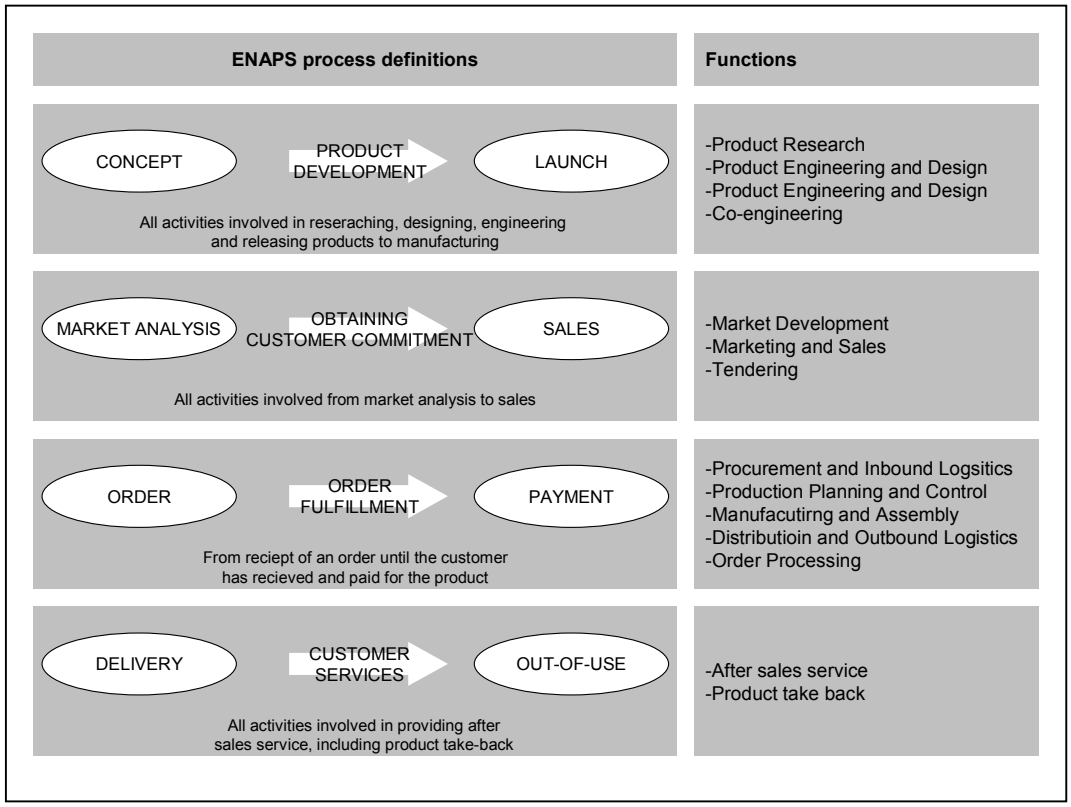

Figure 55: ENAPS Business processes [18]

- *Business level*: Financial and other high level measures referring to the enterprise in total;

- *Function level*: Measures of the functions as for procurement and inbound logistics involved in the customer order fulfilment process and specified in the ENAPS indicators;

- *Process level*: Measures coming from the operational level, when executing the processes as the customer order fulfilment. This is the highest level of detail and mostly difficult to be obtained.

After all the thorough preparatory work, the three consultants (BALance Technology Consulting, Appledore International, and Produtec) contacted 197 European marine equipment manufacturers, who were representative for the various product groups. Initially, 15 companies were prepared to participate, but then approaching the deadline, more companies refused. The main reasons were that the benchmark performance indicators are not available in the companies and that it takes them too much time to collect the data. Ultimately 8 out of 197 participated. This means that the results of the project are not representative and thus rather meaningless. So, in spite of the best efforts of a high quality team and with the support of the EU, the highly relevant benchmark study could not be completed. This experience should be taken at heart when the European maritime clusters are the subject of a benchmark project.

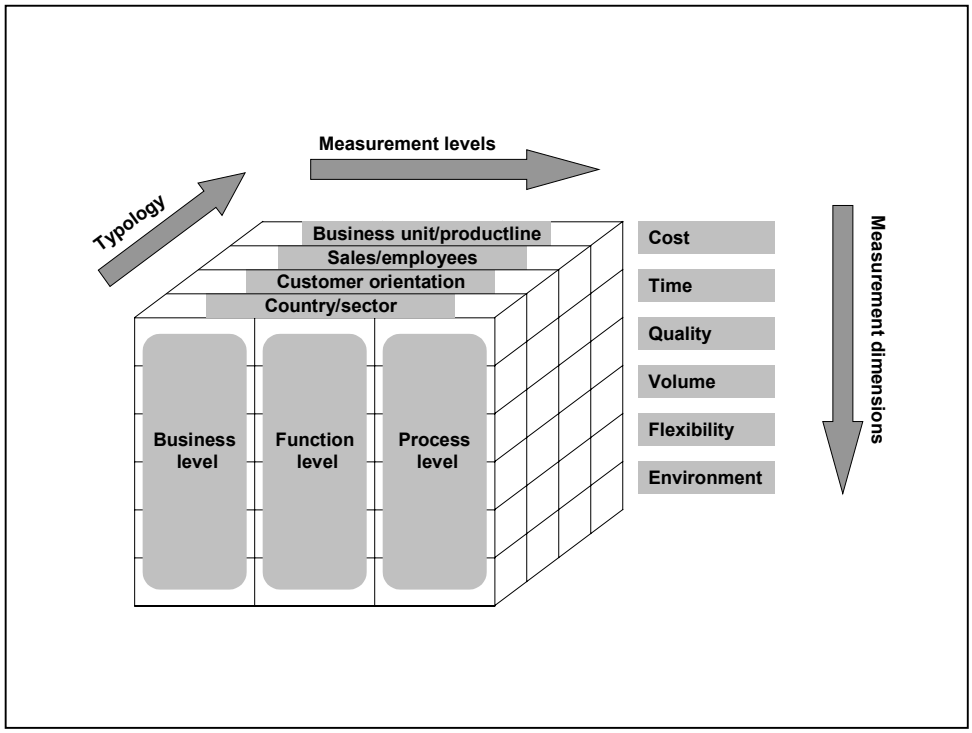

Figure 56: ENAPS Performance measurement cube [18]

There are two ways to overcome this data problem as described above. Either, a bottom-up study is done within the companies, with the help of the consultants. This is rather time consuming and costly, and only a limited sample of companies can be studied. Or, the entire industry decides to co-operate under a neutral platform and shares strategic information on a continuous basis. That was the start of the Profit Impact of Market Strategy, or PIMS project, which started in the eighties in the United States. More than 450 companies and 3,000 business units provided and shared information which helped them to understand the influence of various hypotheses for the business factors that most greatly influence profitability.

The European marine equipment associations, who work together within their trade organisation EMEC, could take an initiative to start a PIMS database for their sector, or a sub-sector in order to help companies define strategic and other performance indicators, which could be implemented in the administrative and management systems. The fact that the companies do not have access to benchmark information, is in itself a worrying situation. *On what information do they take strategic and business decisions?*

5.3. EU competitive benchmarking European shipbuilding

The success and profitability of companies depend to a large extent on the nature of the competitive environment. In many countries there does not exist a level playing-field. Either in the denial of free access to markets, or through direct or indirect subsidies. Every sector has some serious examples:

- *Shipping sector*: many shipowners register their fleet in independent registers, where they pay no corporate taxes; other shipowners obtain derogation from paying income tax over their world-wide income; other shipowners receive operating differential subsidies from their government, like in the United States. Benchmarking of the shipping companies in those countries and circumstances is quite useless.

- *Dredging sector*: Some countries have blocked access to their markets, like the United States through the Jones Act. If the Belgian and Dutch dredging companies were able to compete in an open market for American dredging projects, then they would overnight grab the largest market share and contribute to the efficiency of US ports. Benchmarking of the American dredging industry would be useless, if compared with the European dredging companies since they are protected by law from foreign competition.

- *Fishing sector*: The fishing quotas system which is awarded to each European country is not based on efficiency of the fishing fleet, but on the political decision to maintain employment in some of the countries with big fishing populations, like Spain. Benchmarking of the various fishing fleets would show that, for example, the Dutch fishing fleet, would be the most efficient one. Nevertheless the ultra modern Dutch fleet is currently partly laid-up as a result of the quota system, while the inefficient fleet of other countries still gets EU financial support to modernise and continue to add to the over-capacity.

- *Navies*: there is no other maritime sector which is so protected and shielded from foreign competition as the navy, in particular naval shipbuilding and naval marine equipment. For example the Royal Netherlands Navy has developed – according to many experts – the most advanced frigate in the world, the LCF. However, it is virtually impossible to sell the design of these advanced ships to a NATO ally, as most navies strictly buy from national yards and suppliers. The Spanish government has initiated a merger between the naval shipyard and the loss making commercial yard in the country. As naval shipbuilding budgets are not open for scrutiny by outsiders, the cross-subsidisation between commercial and naval shipbuilding cannot be monitored, which leads to unfair practices. There are some extreme examples of this unfair practice, which the EU likes to play down in order not to weaken its position vis-à-vis South Korea, but this hurts some European shipyards very badly. The world, South Korea, the United States, but also Europe is far from a perfect market place.

A final example will illustrate the extent of the protectionist's problem in great detail: the *shipbuilding sector*. This sector is plagued by unfair subsidies of all sorts. In particular in South Korea, the level of unfair competition has reached great heights, which prompted the Commissioner Bangemann in 1999 to start an investigation, which is still going on. Under Council Regulation 1540/98, concerning new rules on aid to shipbuilding, the Commission is required to report on the situation of the world shipbuilding market. Since 1999 the Commission has undertaken seven studies that

monitor world shipbuilding competition. The reports analyse the latest developments in the world shipbuilding market and assess the results from the actions undertaken[9].

The first Report from the Commission to the Council *On the situation in World Shipbuilding* [19] dates from October 1999. It was triggered by the unjustified expansion of the South Korean shipbuilding capacity in the previous years, and the necessity to fill these new yards at any price. Then came the Asian crisis and the situation got even worse. The Korean chaebol of which the shipyards were part, financed the deficits, often with direct or indirect government guarantees. *Figure 57* shows the rapid Korean building capacity expansion in compensated gross tonnes over the period 1988-1997 from 1.7 in 1988 to 4.6 million cgt in 1997. The Japanese capacity remains constant at 3.6 million cgt, while the European capacity has been reduced from 4.4 million cgt in 1988 to 3.1 million cgt in 1997.

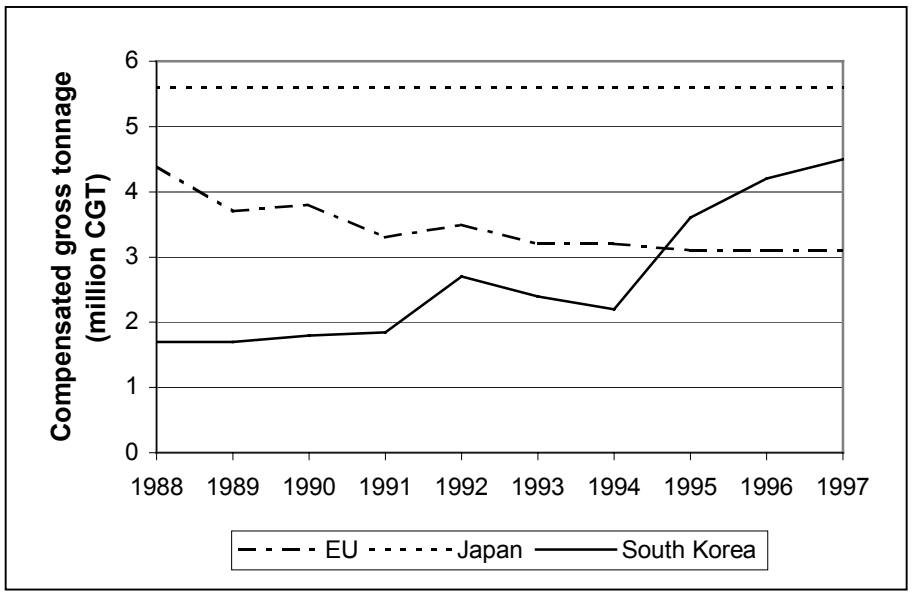

Figure 57: Available building capacities in Japan, Korea and the EU, 1988-1997

The rapid expansion of the shipbuilding output of two Korean *problem yards*, Halla and Daewoo illustrate the situation. In November 1998 Halla shipbuilding announced that its creditors had agreed to write off almost 1 trillion won (US$742 million) of an overall debt of 3.6 trillion won.

Daewoo Heavy Industries in the meantime was buying orders at any price, until bankruptcy followed. But the capacity remains there and new operators can continue, not burdened by normal cost structures.

[9] http://www.europa.eu.int/comm/enterprise/maritime

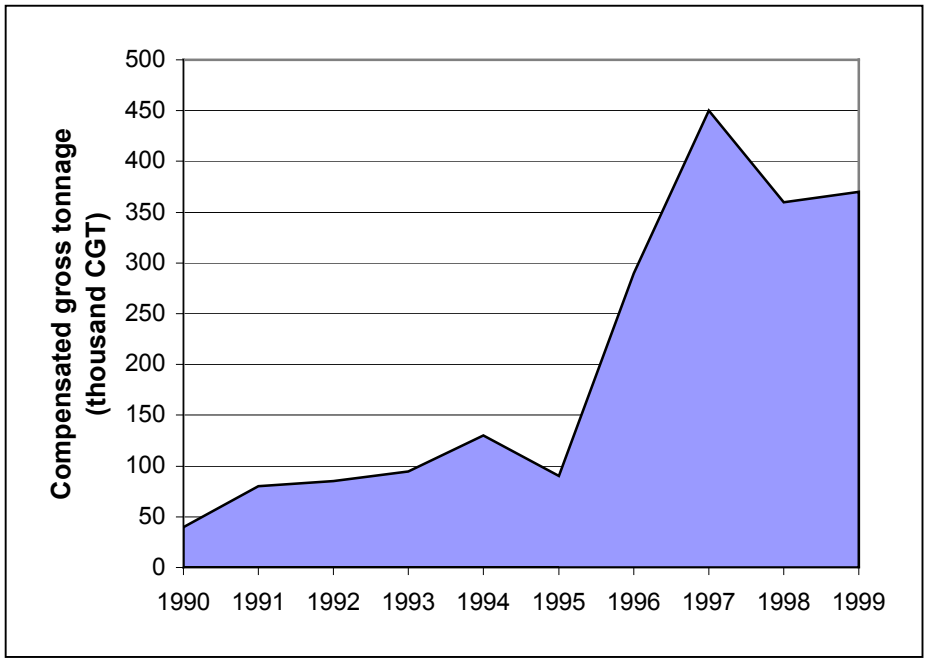

Figure 58: Development of Halla's shipbuilding output, 1990-1999

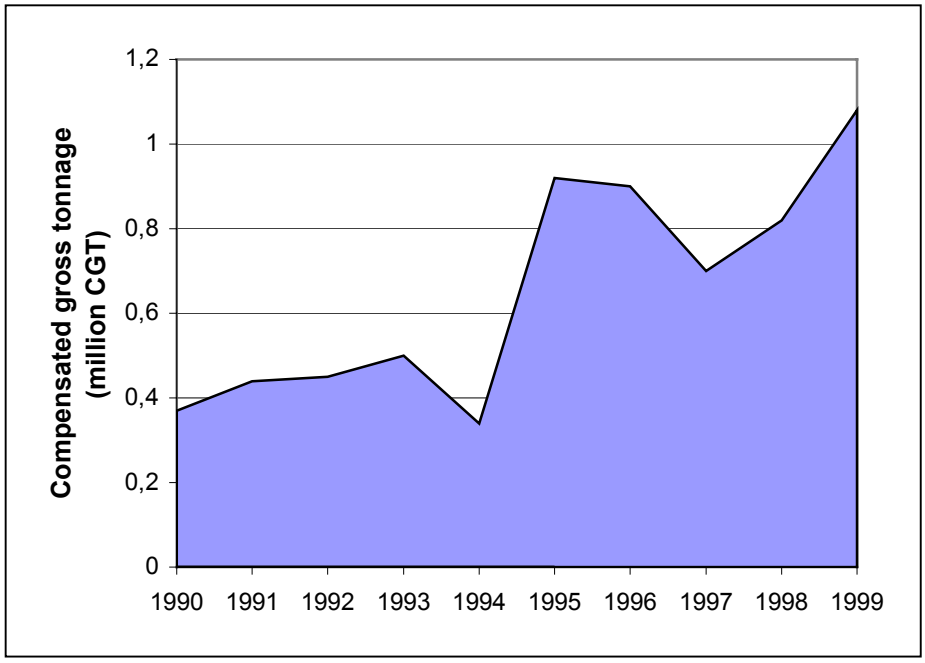

Figure 59: Development of DHI's shipbuilding output, 1990-1999

The Commission asked expert consultants to make a detailed cost model which could help analyse the cost differences between Korean and EU yards. Out of a total of 33 ships 13 new ships were taken to compare the construction prices. Some results are shown in *Table 25.*

The calculations showed that all the orders were loss making. However, there may be some special circumstances that warrant 10-13 percent lower prices. Still, 8 ships should generate losses of between 15-40 percent. Korean yards fix vessel prices

according to the level that the shipyard perceives what the market will bear, rather than through a bottom-up estimate, and production and purchasing targets are set accordingly. Reports indicated that the Korean yards work backwards from the ship price to allocate the value of each item of supply and force local manufacturers to comply. This pricing policy has a direct and indirect effect on European yards. The direct effect is undercutting and taking away orders, the indirect effect is the trickle down on other yards, who start to cannibalise each other.

	Reported order price (million US$)	Calculated building price (million US$)	Loss/gain in % of calculated building price
Cable layer	37.3	45.4	-17.84
Container ship	36.0	56.4	-36.17
Passenger Ro/ro ferry	69.5	90.9	-23.54
Container ship 6,800 TEU	73.5	86.9	-15.42
Container ship 3,500 TEU	38.0	52.3	-27.34
Panamax bulk carrier 1	18.9	31.8	-40.56
Panamax bulk carrier 2	18.5	24.9	-25.70
Product carrier	21.5	24.9	-13.65
VLCC	68.5	84.3	-18.74

Table 25: Cost difference calculation

The Commission also draws a lot of attention to the banking and financial sector in Korea which allocated the rescue funds from IMF's Asian support package. The Korean financial wheeling and dealing resulted in major write-downs of new shipyards, restructuring of loans and cancellation of interest payments. It is easy to compete without having to calculate depreciation of assets and interest on financing, or a return on investment to shareholders. The Commission engaged in a dialogue with the Koreans, to stop their undercutting practices.

In the second Report from the Commission of May 2000 [19], the monitoring was updated and expanded with China's shipbuilding expansion, which is also seen as a potential unfair competitor for European yards. The findings of the first report were confirmed and some progress was made (on paper) with the Koreans to agree on some sort of protocol to discuss the situation, clarify the financial issues, and possibly take corrective actions. In the meantime, the Koreans had increased their market share in the new building market of containerships to almost 65%, reducing the European share over a two year periods from 24% to 14%. This alarmed the Commission further.

On the situation in China shipbuilding, the report concluded that much more research should be undertaken to understand the cost structure of Chinese yards and marine equipment suppliers. The Chinese efficiency was not very high and not perceived as a short-term threat. In the meantime China's output and order book grew steadily as *Figure 60* illustrates.

The third Report of the Commission dated November 2000 [19] confirmed the previous reports and reported little progress with the Koreans on financial transparency. The Koreans had accused the EU of subsidising their shipyards and

therefore the Commission shed some light on the EU shipbuilding support over the last decade (*Table 26*)

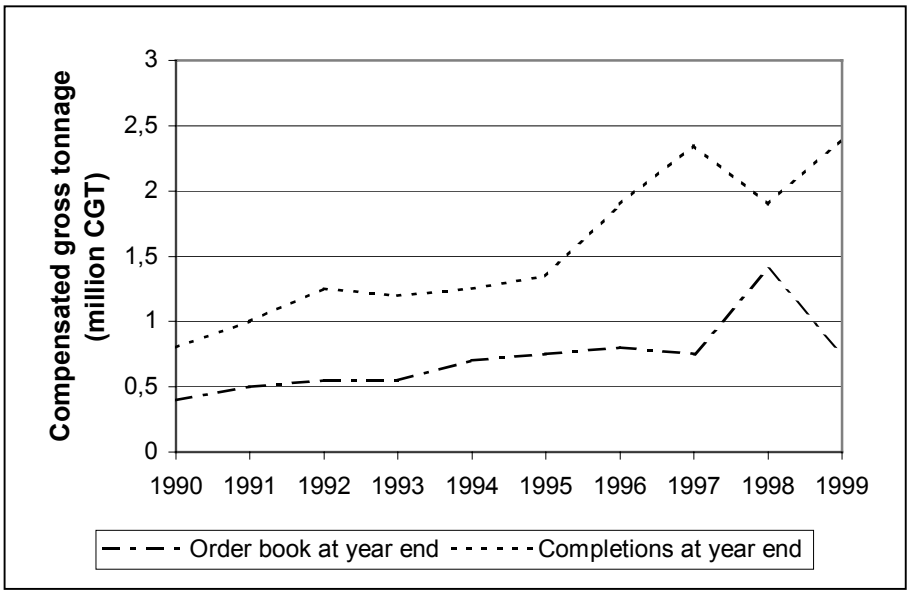

Figure 60: Order book and output in Chinese shipyards

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Operating aid (million €)	1.102	722	198	977	466	855	500	347	548
- Of which for cruise ships	198	43	42	314	84	173	71	135	314
- Percentage operating aid for cruise ships	18%	6%	21%	36%	18%	20%	14%	39%	57%

Table 26: Operating aid provided to EU shipbuilding

The aid per shipyard employee (new building) was €28,000 (!) in 1998. This is extremely high, almost a full annual employee salary. The average national aid in manufacturing was in the EU €1,113 per employee or 25 times less. *Is it realistic to make a benchmark study with this kind of support packages?*

The fourth Report of the Commission was published in May 2001 [19] along the same format as the previous reports. The fifth Report of April 2002 contains some interesting graphs on market shares and price development. (see *Figure 61*)

China increased its market share substantially in 2001; Japan managed to recapture a share from Korea, while the European yards saw their share shrink to an all time low of 13% measured in cgt. The newbuilding price index, which had slightly recovered since the Asian crisis, dropped again in 2002 to where it had started in 1999.

Based on the formidable work of the Commission on monitoring and benchmarking the shipbuilding situation around the world and the unfair practices, which threaten to make the European shipbuilding industry extinct, the Commission decided in October 2002 to file a complaint with the World Trade Organisation. In the meantime, it reinstated the subsidies for the shipbuilding industry to a level of 6%.

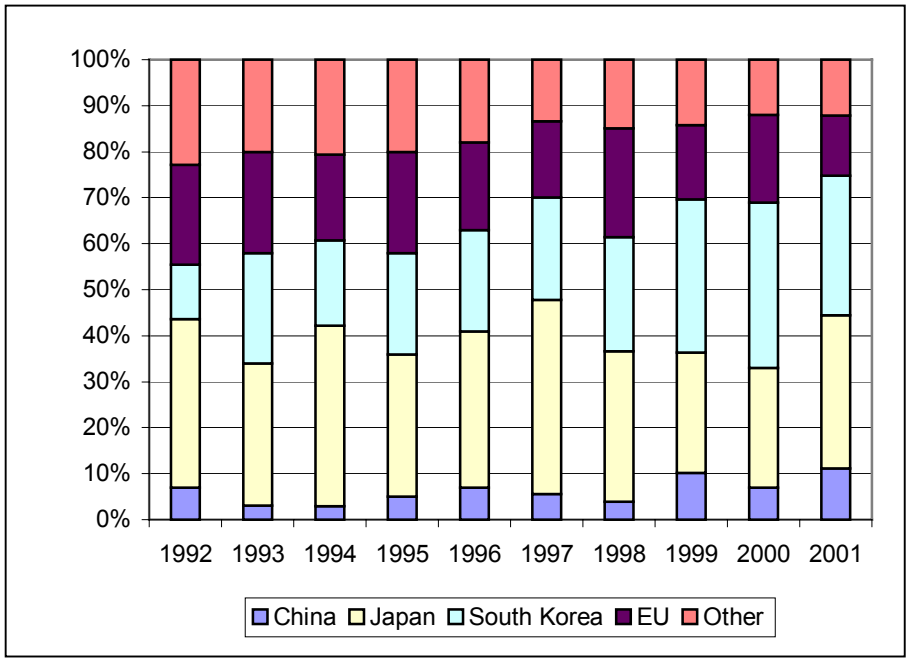

Figure 61: Market shares in new orders in percent and based on cgt (all ship types) [83]

The sixth Report of the Commission was published in November 2002 [19] and discusses the deterioration of the shipbuilding market and the temporary support for EU shipyards. The seventh Report in May 2003 shows the sharp decline in the share of EU yards in the total world output measured in compensated gross tonnes (cgt).

	2000	2001	2002
South Korea	36%	30%	28%
EU	19%	13%	7%
Japan	26%	33%	37%
China	7%	11%	13%

Table 27: Market share in new orders

The European share dropped from 19% in 2000 to 13% in 2001 and the slide continued in 2002 to 7%. In 2003 the sharp increase of the euro against the dollar contributed to a further decline in Europe's share. This example clearly demonstrates the problems with the benchmarking of maritime sectors and the tremendous efforts it takes and the political clout it requires to obtain the necessary information and insight to start a formal procedure against an unfair country. The EU Monitor is a good example of how governments should benchmark the performance of their industries, in particular when level playing fields are distorted.

Illustration 2: Access to US dredging market [64]

This recent article in Lloyd's List, clearly illustrates the protective nature of the US dredging market.

US Court puts block on foreign dredger

Contract awarded to Royal Boskalis subsidiary ordered to go instead to local company Norfolk Dredging

Dredging companies in the US have won the latest skirmish in the long-running war with the Dutch giant Royal Boskalis over control of the US market. The US Court of Federal Claims ordered that a dredging contract first awarded to Bean Stuyvesant, a Royal Boskalis subsidiary, should be granted instead to Norfolk Dredging, a US firm. In seeking to block the award of the contract to Bean Stuyvesant, Norfolk Dredging argued that a *grandfather clause* in the Oceans Act of 1992 exempting the Stuyvesant, a large hopper dredger controlled by Royal Boskalis, from US citizen requirements, could not be allowed to permit the unlimited expansion of Royal Boskalis' dredging interests in the US. US dredging interests took the decision as vindication of their fight to protect the market from foreign competition. Rich Weeks, president of the Dredging Contractors of America, said: *The foreign principals of Bean Stuyvesant developed and exploited a loophole in the law to aggressively expand their position in the US dredging industry, and this opinion confirms that such foreign controlled expansion is not permitted under the law.* Mr. Weeks also repeated the DCA's long-standing argument that the 1992 Oceans Act was framed expressly to ensure *that the US dredging industry would continue to be controlled by US-owned companies in accordance with the federal maritime law*.

Royal Boskalis, through its subsidiary Stuyvesant dredging and its US-owned partner CF Bean of New Orleans, contends that the law is clear and they are permitted freely to charter hopper and non-hopper dredges exactly as they have done for several years. It also argues that the US dredging companies, led by domestic leader Great Lakes Dredge & Dock, are simply trying to drive a strong competitor out of the market. The battle stems from a 1992 amendment to the Dredging Act that applied the 75% Jones Act citizenship requirements to all dredges, and all companies owning or chartering dredges, working US navigable waters. When the amendment was passed, the Stuyvesant, US-flagged and US-built, but chartered to Stuyvesant Dredging, was granted an exemption from the minimum citizen requirement.

Four years ago Stuyvesant and Bean formed the 50-50 joint-venture Bean Stuyvesant, which has been highly successful in bidding on projects around the US. The battle has been intense since then, with both sides spending heavily on Washington lobbying and assembling regiments of backers on Capital Hill.

In testimony to Congress last May, CF Bean chief executive James Bean said both Customs and the Coast Guard had approved its operating structure many times. He also observed that in the four years of its existence Bean Stuyvesant had invested more than US$50 million in the US equipment and had successfully bid on more than 40 jobs, saving the taxpayer around US$100 million. It owned no dredges but chartered in only US-built, US-flag dredges with US crews for use on local projects, just as the law intended. He argued that, while it operated only seven chartered dredges or 5% of the US total, and so represented no real threat to the market, its presence brought increased competition and lower prices for US ports and waterways. Describing his opponents as seeking *a pretext to eliminate Bean Stuyvesant as a competitor*, he said: *The end game of this effort is to reduce the competitors on dredging projects from three or four to two or three.*

At the same hearings Mr. Weeks countered: *Royal Boskalis now effectively controls 16 dredging and support vessels through Bean Stuyvesant. If this exploitation is allowed to continue Royal Boskalis' stated strategy of expansion and consolidation could well lead to its domination of the US dredging market*

5.4. Benchmarking and innovation: European innovation scoreboard

The European Innovation Scoreboard 2001 is the main statistical tool of the *European Trend Chart on Innovation* [20]. It was developed by the European Commission, as requested by the Lisbon Council in March 2000. An annual update of the 2001 Innovation Scoreboard is made. The European Innovation Scoreboard compiles a set of innovation indicators under four categories:

- Human resources;
- Creation of new knowledge;
- Transmission and application of knowledge;
- Innovation finance, outputs and markets.

It allows relative strengths and weaknesses of the innovation performances of the EU Member States to be assessed and, for a limited number of indicators for which comparable statistical data is available, to contrast the performances of the European Union with those of the United States and Japan. Benchmarking national innovation *policies* is done as well under the EU Innovation Trend Chart project. This project does not only aim at building a comprehensive and up-to-date set of information on innovation performances and innovation policies at work in Europe. It also aims at putting this knowledge in motion for the improvement of policy practices. To this aim, several benchmarking workshops are organised, focusing on themes that are viewed as crucial for the building of efficient innovation policies. Existing information and analyses on innovation policy approaches and instruments, as well as data and indicators built under the Innovation Scoreboard, are exploited, with the involvement of policy makers and practitioners themselves.

The Innovation scoreboard is one component of a much broader benchmarking exercise of DG Enterprise, covering European enterprise policy and competitiveness as a whole. The Lisbon European Council in March 2000 adopted the objective of making Europe the world's most competitive and dynamic knowledge based economy. Enterprise policy is at the heart of this strategy. The second European Competitiveness Report 2002 [21] contains an array of benchmark criteria for competitiveness. It is surprising that export quotes are not part of this comprehensive exercise. The four categories of EU innovation scoreboard indicators, human resources, creation of knowledge, transmission and application of new knowledge, and innovation finance, output and markets, are sub-divided into a total of 18 indicators.

The scale and quality of *human resources* are major determinants of both the creation of new knowledge and its diffusion throughout the economy. The indicators are divided into two groups: three indicators for education and learning and two indicators for employment. The former includes the supply of new scientists and engineers, the skill-level of the working age population, and a measure of life-long learning. The two employment indicators are the share of the workforce in medium-high and high technology manufacturing and in high technology services. These indicators reflect the

structural focus or pattern of specialisation of each economy on sectors that are likely to have a high innovation content. The three indicators for the *creation of knowledge* measure inventive activity: public R&D expenditures, business R&D and patenting. The latter has two sub-categories: high technology patents at the European Patent Office and high technology patents at the US Patent Office.

Transmission and application of new knowledge covers innovation activities outside formal invention, such as the adaptation of new equipment to a firm's production and service systems, adopting innovations developed by other firms or organisations, and adapting new knowledge to the firm's specific needs. Collecting data in this area is relatively new to the national and international statistical systems. The section, therefore, relies entirely on the second Community Innovation Survey which is the only source of comparable European data for innovation diffusion. The indicators on in-house innovation and co-operative innovation are limited to small and medium-sized enterprises (SMEs). They provide a better picture of the innovative status of SMEs than business R&D, which is more prevalent among large firms. Separate data for SMEs is worthwhile because they form the majority of firms in most countries and can play a vital role in innovation: as intermediaries between the public research infrastructure and large firms, as developers of new ideas, and as adopters of new technology.

Innovation finance, output and markets includes six indicators that cover a range of issues: the supply of high-tech venture capital, capital raised on stock markets (new markets or newly admitted firms on main markets), sales from innovations, home internet access (structural indicator), ICT investment (structural indicator), and value-added in advanced manufacturing sectors.

Figure 62 summarises conditions in each country by giving the summary innovation index (SII) and the average percentage change in the indicators for which relevant data are available. Countries above the horizontal axis have an above average SII, while countries to the right of the vertical axis show an overall trend above the EU average. These two axes divide the chart into four quadrants. Countries in quadrant 1 are *moving ahead*, those in quadrant 2 are *losing momentum*, those in quadrant 3 are *catching up*, and finally countries in quadrant 4 are *falling further behind*.

The European Competitiveness Report [21] and the European Innovation Scoreboard [20] demonstrate the complexity and the problems associated with the quantification of the level of innovation of companies, sectors, and countries. The question is whether this can be done in a meaningful way for the maritime sectors and the maritime cluster as a whole because of the lack of reliable and representative data. A Dutch study into the innovativeness of the maritime cluster [89] demonstrated that one needs detailed data of a very large sample of companies in order to arrive at meaningful innovation indicators.

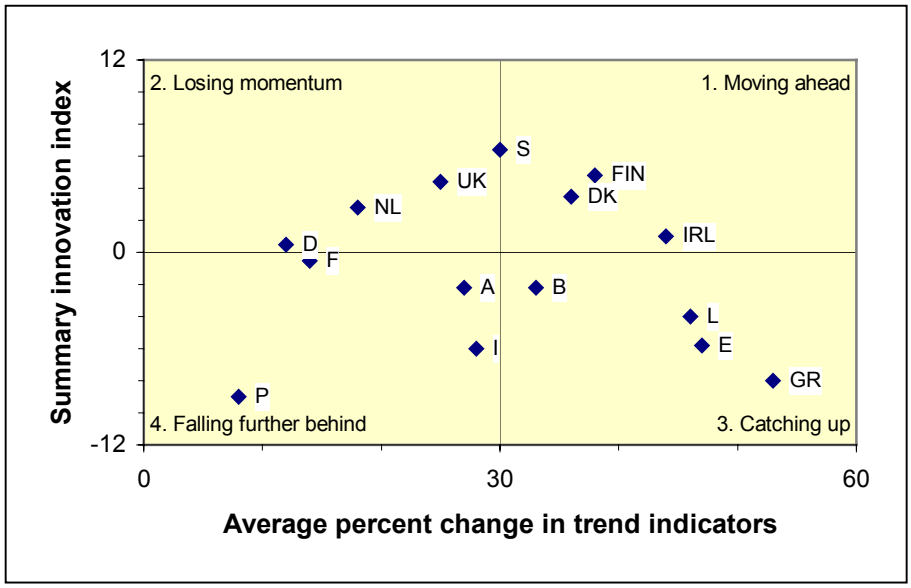

Figure 62: Overall country trends by innovation index [20]

5.5. Cluster evaluation methodology

Based on the discussion of the problems related to benchmarking of the maritime cluster and the theoretical discussion in *Chapter 4*, it is proposed to evaluate the clusters of the Netherlands and Norway on the basis of quantitative and qualitative indicators. These indicators can be grouped under nine headings:

1. *Structural indicators.* Type and number of maritime sectors, and number and size of companies. The broader the cluster in terms of sectors, the greater its potential synergy and strength. Sectors within the cluster that order new capital equipment (cluster drivers: shipping, offshore, inland shipping, dredging, fishing, naval) have a stronger impact on cluster dynamics than the supply sectors. Clusters are also characterised by their regional make up, which show different competitive advantages within a country and the cluster.

2. *Economic indicators.* E.g. the value creation of the cluster, expressed in direct and indirect value added, employment, backflow to the government, (foreign direct) investment, export quote and balance of payments contribution, growth over time.

3. *Internationalisation.* The ability to export is a clear indication and empirical evidence that sectors and companies are able to compete in the world market, and are thus by definition competitive; maintaining this export position – in the absence of subsidies – can only be achieved if the companies remain innovative and market leaders.

4. *Critical mass and leader firms.* The larger the maritime sectors and maritime cluster as a whole in a country, in terms of turnover and value added, the more chances there are that companies become leader firms. Maritime leader firms are able to initiate innovation processes on a large scale, thereby integrating

many smaller suppliers and stimulating them to innovate and export as well. The presence, the number and market share of maritime leader firms in a cluster, is a clear indication of the ability of a maritime cluster to export, innovate and upgrade itself.

5. *Level playing field*. Unfortunately, in many maritime markets there exists no level playing-field. These markets are distorted by regulations that prohibit access, protect industries by subsidies, or more in general, induce companies to seek fiscally sunnier climates. Countries that are able to create a level playing-field for their maritime clusters, have a better chance to have leader firms, innovation, export, value added, critical mass and upgrading mechanisms.

6. *Innovation.* The presence of a strong maritime services sector and marine equipment sector are good indicators for the innovative strength of the cluster and the pace of diffusion of innovation within the cluster. The marine equipment sector is an important intermediary to adapt innovations from one sector to another and to translate national and foreign demand into new products and processes.

7. *Institutional framework and business networks*. The quality of the maritime trade organisations, the quality of the cluster networks, the level of interaction with policymakers and politicians, all determine the strength of the cluster. The stronger the networks, the greater the chance of cluster dynamics and upgrading.

8. *Labour market and education*. A cluster requires a broad set of expertise and a high level of education. A large cluster offers many employment opportunities and increases the attractiveness to chose for a maritime career. A broad and specialised educational infrastructure will help to maintain the innovativeness of the individual sectors.

9. *Image and communication.* A positive image and a continuous two-way communication effort between the cluster, the policymakers and the general public is of the essence if the cluster wishes to attract to best people and maintain a high-level of dynamics.

6. THE MARITIME CLUSTER OF THE NETHERLANDS

6.1. Introduction

Maritime history of the Netherlands

The Netherlands is a small country in size, some 300 kms in length and 200 kms in breadth, which makes it possible to reach every location within hours. It is strategically located on the North Sea and the largest river of Europe, the Rhine, which connects it with the heartland of Europe [11]. These two elements have to a large extent shaped the maritime and cultural past of the Netherlands.

The western part of the country is partly below sea-level and this triggered the organisation and construction of collective defences against the treacherous sea, the polder and dykes system. The earliest maritime involvement of the seven Provinces that originally made up the Netherlands, was fisheries, sea transport and trade, and water works, of which dredging is an integral part. Fish was the staple food, as the agricultural (arable) land and output was not enough to support a growing population [51].

Some cities participated in the economic union of the Hansa cities cluster, which had developed around the Baltic Sea. From this experience and involvement, the short sea shipping trades grew, where fish, salt, timber, grain and the like were cross-traded and the Dutch traders/shipowners made the Netherlands into the largest maritime nation of Europe.

Shipping, shipbuilding, marine equipment, fishing, water works, inland shipping, the navy, and maritime services developed at an astounding rate. Financial services, like insurance and banking were innovated; this made it possible to finance risky deep sea exploration trips to the Far East. The various expeditions were competing against each other, to the detriment of all, and this led the government to propose a merger of all the trading and shipping interest in 1602 with the creation of the VOC, the Dutch East Indies Company [27]. The first stock traded multinational company in the world. In 2002 the Netherlands commemorated the 400th anniversary of the founding of the VOC. The history of the company has been well documented and provide an insight into the incredible creativity and innovation at all levels, from management, to accounting, pool agreements, stock options, share trading, insurance, but also technological developments, like the first purpose-built integrated shipbuilding and marine equipment manufacturing site in the world: Oostenburg, in Amsterdam.

The deep sea trades created a tremendous wealth in this Golden Age, which made it possible to built sophisticated cities, order paintings, or make polders of the many lakes in the western provinces of Holland. The Dutch innovated pleasure yachting as a past-time which explains the strong position today of this sector.

Shipping and trading formed the backbone of the economy, but also moulded the Dutch culture and mentality. An open attitude to the world and a curiosity – not without self-interest – to explore new ways and routes. This is still reflected in the economy, where a major share of the national income is based in imports and exports and value added services to these flows.

The ports sector was also an important shackle in the logistical chain. The only problem with the Dutch ports was that the access was difficult, because of a limited draught and the dunes along the coastline. The sailing vessels often had to wait a long time for a favourable wind to be able to sail. At the same time the technological advances of the steam engine into shipping and shipbuilding led to knew demands on ports. This was reinforced by the construction and opening of the Suez Canal in 1869, which shortened the route from Europe to the Far East considerably in comparison with the route around the Cape Good Hope. The sailing vessels were not allowed to pass the Canal and the Dutch lost most of their captive trades to and from their colonies to the British shipowners, who had invested early in steamships.

In order to accommodate the change in shipping, the Dutch ports of Rotterdam and Amsterdam decided to make new access channels directly through the dunes to the sea. So, the New Waterway connected Rotterdam and the Northsea Canal (with locks) connected Amsterdam with the sea. These investments gave an important impetus to the industrial development in these port regions and to the transhipment function of the Netherlands, mostly based on the very efficient and low cost inland shipping sector. This in turn facilitated the growth of the German steel industry.

In the first half of the twentieth century the Netherlands had become one of the leading nations in the world in shipowning, shipbuilding, marine equipment, ports, inland shipping, fishing, dredging, yachting, navy, and maritime services. The maritime cluster existed without an explicit understanding of its functioning and success factors. The Dutch maritime sectors had survived the world economic crisis of the thirties, but were severely damaged after World War II. The shipping fleet had played an important role in the provision of the allied forces, but was decimated and many sailors lost their lives. The port of Rotterdam was bombed and partially destroyed, the (shipbuilding) industry was partly dismantled as equipment and material was transferred to Germany to support the war effort. The East-Indies were lost which left a enormous cross-trading fleet of several hundred general cargo ships idle. The navy was destroyed and the other sectors like inland shipping under-employed as the industry in the German hinterland was in shambles.

The early maritime history of the Netherlands has formed the basis for a very deep and diversified understanding and knowledge of the maritime sectors. The ups and downs of economic cycles and even a tragic war have not been able to destroy the strong maritime cluster. The economic recovery and the consequent explosion of world trade helped to re-establish some of its former glory, but also to change the competitive position dramatically with new entrants, new market segments and new forces which distort competition. These post-WW2 developments have shaped the current situation

of the cluster in the Netherlands and these developments will be briefly discussed in the following paragraph

Structural development since 1950

World trade grew very fast and created new opportunities for tanker and bulk shipping. The increase in economy of scale of ships was anticipated by the port of Rotterdam and this development helped the port to grow in transhipment, but more importantly into an attractive location for international, mostly petro-chemical, industries. The investment in port expansion influenced in turn shipping, for example the dredging of the very deepwater access channel to Rotterdam, which made it possible for fully laden VLCCs to enter the port.

The introduction of bulk carriers in the mid-fifties created a revolution in bulk commodity shipping. The Dutch shipowners, who were mostly liner operators, did not really participate in the rapid expansion of the bulk shipping markets, and therefore missed out on one of the most important opportunities of the post-WW2 period. The same is more or less true for oil tanker shipping, which remained linked to the national oil major and was not taken up by independent owners, like in Norway and Greece. The lack of oil tanker involvement may have been a blessing in disguise when two successive oil crises halved transport demand for oil tankers and a painful and costly restructuring process started which lasted well into the nineties.

The Dutch had been strong in general cargo shipping, but also this market was faced with the loss of the cross-trading business in the Far East due to the loss of the colonies, and the structural change which the container was about to bring. The Dutch were early in the race to design and built containerships and are still today co-operators of one of the top container companies in the world. The other shipowners expanded their short sea presence to a deep sea level and created many new market niches, like heavy lift, reefer and forest products.

The shipbuilding industry got involved in an early stage in the building of very large tankers and specialised tonnage, like dredgers and passenger vessels, but also very simple short sea ships. The marine equipment industry benefited from these developments in shipbuilding and it became a force in itself. The maritime cluster of shipowners, shipbuilders and marine equipment manufacturers in the northern provinces became the precursor of the cluster awareness in the Netherlands, especially after Porter introduced this economic concept.

The oil crises had prompted a search for oil and gas offshore and the Dutch benefited from the presence of many oil and gas companies which got involved in this new market, especially as equipment suppliers and the construction and installation of offshore platforms and pipelines. In the offshore services field, Dutch companies became world leaders in their segments. The sector has become in a relatively short period one of the backbones of the maritime cluster.

The dredging industry used its home market to develop advanced cutter and hopper dredger technologies and other specialities required in the offshore industry. It benefited from the port expansion in many (developing) countries and the land reclamation in coastal areas, as well as the deepening of ports and channels to accommodate the ever bigger ships.

The inland shipping sector formed the foundation of the competitive transhipment position of the Dutch ports; the sector innovated many new ship types which corresponded to the innovations in deep sea shipping, in chemical, gas and containers. Its growth and increasing market share in Europe, created a revival in this once traditional sector.

The yachting sector grew on the basis of a tremendous home market; the Netherlands has the highest density of pleasure yachts per inhabitant. The upscale super-yachts expanded in the nineties when this expression of wealth became fashionable all over the world. The Dutch mega-yacht builders now rank third in the world.

The fishing industry modernised early, using the advanced knowledge of automation of operations from the dredging and other maritime sectors. Unfortunately, the over-fishing in European waters introduced a quota system, which not only limited this once very successful sector in its expansion, it also forced it for political reasons to reduce its fleet for the benefit of less efficient fishermen in southern European states.

The Dutch navy rebuilt its fleet and became a technology leader reinforced by the drive to reduce (manning) costs. Its frigates are the most modern in the world and have a unique naval presence, with a minimum crew. Advanced design and equipment (radars) have stimulated research and development in many ways.

The maritime services sectors comprise many smaller segments, like ship financing and research and development. The Dutch ship finance sector has become a world force using its international banking network and know how. The major research institutions and many smaller consulting companies support the other sectors in their growth and renewal processes.

Structural changes in the Dutch maritime sectors occurred continuously during the period 1950-1980 in shipping, shipbuilding, marine equipment, dredging, offshore, inland shipping, maritime services, navy, fishing, yachting and the ports sector. Describing all the changes in a thorough way would result in a book itself. There are, however, two changes that had a very large and negative impact on the maritime cluster as a whole, and should be mentioned specifically: the shipbuilding crisis following the oil crises of the seventies, and the continuing shipping crisis of the eighties.

The dramatic reduction of European shipbuilding and the changes in shipping have been discussed in *Chapter 2*: *The Rise and Fall of Maritime Nations*. *How did the Dutch adapt to these fundamental and sudden changes?* The shipbuilding industry

restructured rapidly and embraced a new operating concept, the assembly plant, in close partnership with many suppliers and sub-contractors and in close co-operation with the articulated market demand for the shipowners. A low-cost, flexible and innovative shipbuilding industry emerged which was very strong in certain market niches.

The shipping industry had to reduce costs dramatically and its solution was to register the ships under international registers, thus reducing manning costs, and transferring in some cases their ship owning activities abroad. The relatively expensive Dutch crews were replaced by cheap third world crews. The Dutch flag fleet dwindled in size and this led to a steep reduction in newbuilding orders for Dutch shipyards as well. The situation became dramatic and acute, this in spite of the very positive attitude of the Dutch government towards shipping. The Dutch shipowners association convinced the government to look into the fundamental problems of the industry and to devise a daring new shipping policy. This resulted in 1993/94 in a study which led to fundamental and successful policy changes in the Netherlands, and the beginning of the cluster organisation Dutch Maritime Network [79].

Dutch Maritime network

The shipping study of 1993/1994 created a number of quantitative insights and on that basis it recommended a number of policy measures. The new insight was that the biggest value added of the shipping sector, was not created on board Dutch flag ships by the Dutch crews, but on shore by the shipping company's staff and activities. Seventy percent of the value from shipping was created on shore and only thirty percent on the ships. This led to a change in policy focus from *supporting the flag* to *creating a level playing field for Dutch shipowners*. The latter objective was realised through a number of policy measures, such as the introduction of the tonnage tax, the cancellation of detailed manning regulations and a financial contribution to the shipowner as a compensation for a part of the social charges.

The measures were implemented within one year as off the 1st of January 1996 and proved to be even more successful than forecast by the consultants who made the shipping study. A large number of ships came back to the Dutch register and many new ships were ordered, often at Dutch yards. *Figure 63* shows the development from 1997-2002.

This stimulated the government to initiate a second recommendation of the Shipping Study: to reinforce the network around shipping and to create more value added from the entire maritime cluster with all its sectors. The private sector took the initiative to found the Dutch Maritime Network in June 1997 with an independent board of maritime industry leaders and financial support from the trade organisations and the Dutch government (Ministries of Transport and Economic Affairs).

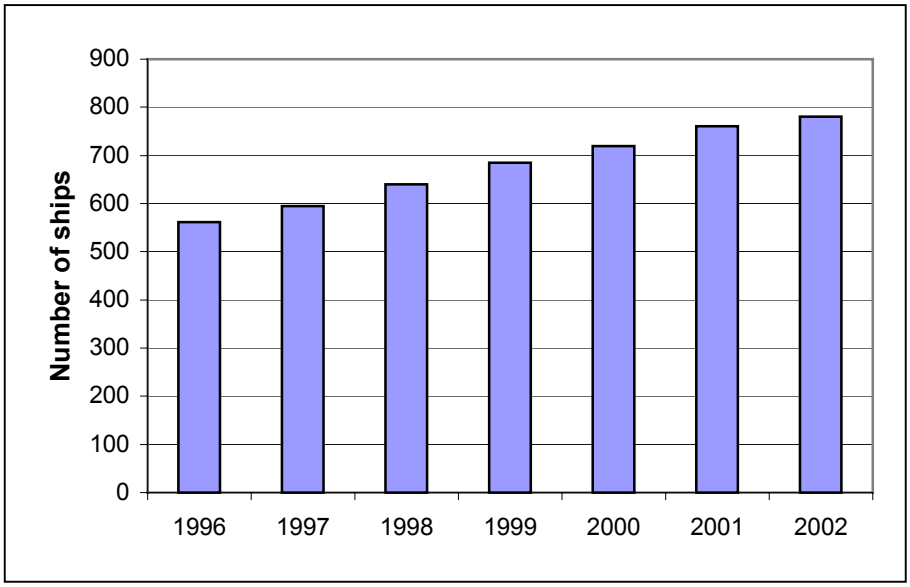

Figure 63: Fleet development 1996-2002

The objective of the Dutch Maritime Network was and is to promote and strengthen the Dutch maritime cluster. Since its inception it has taken many initiatives, based on thorough research and understanding of the Dutch maritime sectors. The studies have been published and this chapter is based on the findings and the insights created by this work during the past six years. The work of the Network is appreciated by the Dutch maritime sectors and the government and as a proof of this, the support for its work was continued after an in depth evaluation on behalf of the government. Its groundbreaking approach has also been copied elsewhere, just like the new shipping policy.

6.2. Structure of the cluster

The paragraph is based on studies published by the Dutch Maritime Network over the period 1998-2003 [80][81] [82][83].

Maritime sectors and cluster definition

The Dutch Maritime Network started out in 1997 with a rather limited insight into the structure of the maritime cluster, this in spite of the wide knowledge of its board and members and the individual trade organisations. For example, the marine equipment sector was not perceived at that time as a separate sector, but part of the shipbuilding sector, while the maritime services sector was so fragmented that it was difficult to speak of one sector.

The first task of the research project was to define the sectors within the maritime cluster, establish its economic significance for the Dutch economy, assess how the sectors interact and reinforce each other, and finally devise policies to strengthen the entrepreneurial dynamics of the cluster. It was an ambitious project that took much time and resources. The eleven-sector structure of the Dutch maritime cluster, which emerged ultimately, is schematically shown in *Figure 64*.

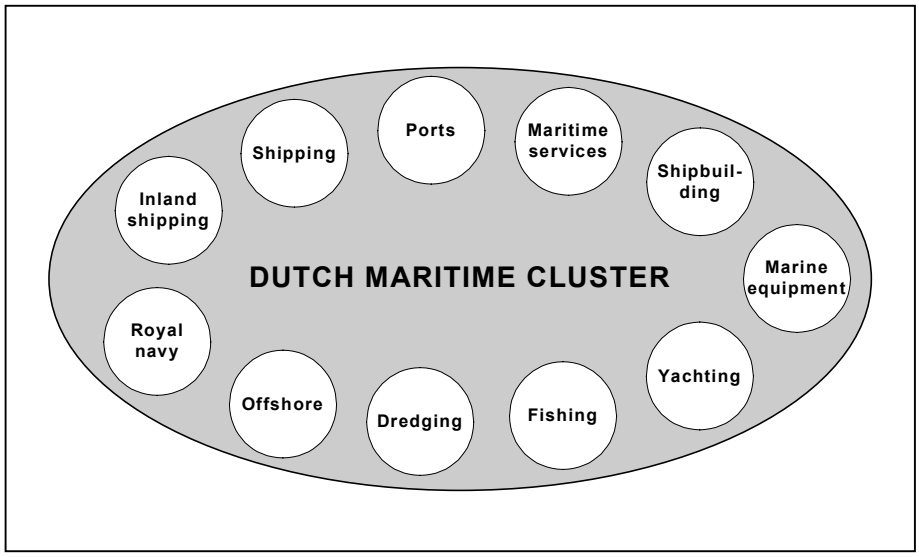

Figure 64: Structure of the Dutch maritime cluster

Most sectors are part of more than one cluster, which complicates the definition problem and the data collection. Only the maritime components of each sector are considered to be part of the maritime cluster. The dredging sector is part of the construction industry; the offshore sector is part of the energy sector; the navy is part of national defence; the inland shipping, shipping and ports sectors are also part of the logistics and transport cluster; the ports sector is also part of the port-related industrial cluster, the shipbuilding, the marine equipment suppliers and the offshore suppliers are also part of the metal and machine working cluster; the yachting sector is also part of the leisure and tourism industry; the fishing sector is part of the food processing industry. Again, the maritime components of each sector is deemed to be part of the cluster. Defining the boundaries of each sector is therefore important not to overstate the true size of the maritime cluster. The consultants had to make a major effort to obtain the co-operation of all the companies in the detailed data collection and sub-division of sectors into many smaller segments. The eleven sectors were sub-divided into 67 segments. There are approximately 12,000 companies within the cluster; the number per sector in 1997/98 is shown in *Table 28*.

Sector	Number of companies
Shipping	364
Shipbuilding	101
Marine equipment	622
Offshore	343
Inland shipping	4,110
Dredging	296
Ports	639
Maritime services	728
Fishing	795
Yachting	3,851
Royal Navy	1
Total	**11,850**

Table 28: Number of companies per sector

The table shows the structural differences between some of the sectors. The Royal Netherlands Navy is just one *company*, but with over 17,000 employees it is also the single largest maritime employer. The inland shipping sector is characterised by many small and medium size enterprises (SME), which co-operate in large commercial pools and thereby create major virtual companies. The number of market players is therefore a fraction of the 4110 individually registered companies.

Description of the sectors

The *shipping sector* comprises all the companies registered in the Netherlands and involved in the operation of ships on their own behalf or on behalf of third parties in or outside the Netherlands. The flag registration of the ships is thereby irrelevant.

Within the *shipbuilding sector* five segments were distinguished: newbuilding of ships, repair and conversion of ships, newbuilding and repair of inland ships, newbuilding of mega-yachts, newbuilding and repair of naval vessels.

The *marine equipment suppliers sector* is split into thirteen segments related to the equipment categories, like propulsion systems, deck equipment, safety equipment and so on. There are many companies that are manufacturers of equipment, but a major part is trader and importer of equipment. Therefore in the quantitative analysis, two groups of companies have been distinguished: manufacturers and traders.

The *offshore sector* is extremely divers and a simple definition of this sector is therefore difficult to give. The sector defines itself as *all activities, on land and on sea which are necessary for the exploration and exploitation of the resources in the sea, on the seabed or under the bottom of the sea*. The sector is divided into four segments: exploration and drilling, construction and installation, engineering consultants, other offshore companies.

The *inland shipping sector* is made up of eleven segments, related to the nature of ships and their company size. For example, the categories bulk, tanker and container shipping, at the individual entrepreneurial level or at the larger company level.

The *dredging sector* has been divided for this study into five segments, related to the geographical level of the operations (world-wide, Netherlands and Europe) and the specialised small scale segments in the Netherlands, like transport of sand. The number of world-wide operators is very small, but these leader firms have a large impact on the size and expansion of this industry.

The *ports sector* is limited to those economic activities and companies that are involved in the physical handling of maritime cargoes. This comprises stevedoring companies, shipping and port agents, forwarders, pilots, and port management. Industrial activities which are port related and make up a large share of the value added of ports, are excluded from this definition, as well as road transport companies that carry the freight to and from the ports, even if these are located within the port perimeter. Other port services like surveyors, are classified under the maritime

services sector. Tug operations within the port are part of the shipping sector, or inland shipping sector.

The *maritime services sector* is a rather fragmented sector, made up of seven segments: salvage and diving, bunkering and ship supplies, control and inspection, insurance and surveyors; maritime research and consultancy, other professional and non-professional services like education and training.

The *fishing sector* is made up of four segments: deep sea, short sea and inland fishing, and the production of shellfish. Aquaculture and fish processing are excluded from this definition, as only the maritime activities are taken into account.

The *yachting sector* is divided into six segments which are yachts smaller than 24 metres (the mega-yachts have also been included in the shipbuilding sector by the consultant), whole-sale traders, retail traders, marina related services, ship related services like architects, brokers, and financing, tourist related services like the yacht rental business.

Finally, the *Royal Netherlands Navy* is a sector all by itself. Within this sector, four segments have been defined: maritime operations, Royal naval shipyard and engineering, education, training and research, and management staff and administration.

Organisation of the sectors and cluster

The companies in the maritime cluster have organised themselves in trade organisations. Most of these institutions live from contributions of their members and commercial activities on behalf of their members, like the organisation of trade shows. Their main function is to further the causes of their members and to lobby at the various levels of government: local, regional, national and European. Either directly or through their membership of European or world-wide organisations. *Table 29* shows the structure of the Dutch maritime trade organisations.

The size and revenue base of these trade organisations differs widely. Consequently, the level of services and activities that these organisations are able to offer to their members varies accordingly. The scale is in general small given the many forums in which they participate and the political and professional issues they have to address in the Netherlands and in Europe. Their resources are stretched which limits their span of control and participation. The trade organisations form an essential element in the networks that constitute the maritime cluster. The strengthening of these networks is an important condition for the dynamics in the cluster as a whole.

Some trade organisations have created critical mass by merging, like for example in the past the two separate short sea and deep sea shipping organisations. Additional merging could add to more critical mass in or across other sectors.

Sector	Trade organisations
Shipping	Koninklijke Vereniging van Nederlandse Reders (KVNR)
Shipbuilding	Vereniging Nederlandse Scheepsbouw Industrie (VNSI)
Marine equipment	Holland Marine Equipment (HME)
Offshore	Industriële Raad voor de Olie- en gasindustrie (IRO)
Binnenvaart	Centraal Bureau voor de Rijn- en Binnenvaart (CBRB) Het Kantoor Koninklijke Schuttevaer
Dredging	Vereniging van Waterbouwers in Bagger-, Kust-, en Oeverwerken (VBKO)
Ports	Deltalinqs, Rotterdam Ondernemingsvereniging Regio Amsterdam (ORAM) And a host of small trade organisations
Maritime services	Nederlandse Associatie van Duikondernemingen (NADO) Nederlandse Vereniging van Scheepsleveranciers (NVS) Brancheorganisatie Maritiem Onderzoek en Consultancy (BMOC) And a number of small trade organisations
Fishing	Productschap Vis
Yachting	Nederlandse vereniging van ondernemingen in de bedrijfstak waterrecreatie (HISWA)
Navy	-

Table 29: Dutch maritime trade organisations

The picture is more complicated in the ports sector, as maritime, logistics and industrial clusters are represented jointly in trade organisations. It is not possible, neither useful to separate these maritime clusters from the other regional clusters. But this definitely changes the focus of such organisations and the ability to concentrate its activities and resources on the maritime cluster. A new development has been the creation of a maritime cluster organisation on a regional level, for example in the province of North-Holland or in the Drechtsteden-triangle of cities.

Ideally, in the years ahead, the maritime trade organisations should merge into larger units in order to be able to play a more effective role in the political lobby, as well as in the other professional domains, like education, labour market, export, innovation and communication. At the same time regional maritime clusters should be stimulated in order to play an integrator role at the local level.

The Dutch Maritime Network was created in 1997 as a platform and network organisation for the maritime trade organisations. The network is not a lobby organisation. It only facilitates the articulation of the major policy issues for the participating maritime trade organisations. These organisations have an advisory role for the board in the decision making process of the Network. The government has an observer on the board, but has no direct formal power of the spending of the funds which it puts at the disposal of the cluster organisation. All the relevant trade organisations have become member of the Dutch Maritime Network since its inception. Many of its staff members participate in the various policy forums which have been created to address the challenges as defined by the board.

6.3. Economic structure

This paragraph summarises the economic structure and significance of maritime cluster. The many details of the extensive calculations which form the foundation of these figures, are documented in published reports.

Economic structure and significance of the sectors

The economic significance of the maritime cluster is expressed in terms of direct and indirect production, value added and employment. The value added also has an impact on the back flow to the government and other macro-economic variables. *Figure 65* shows a schematic overview of all these economic impacts.

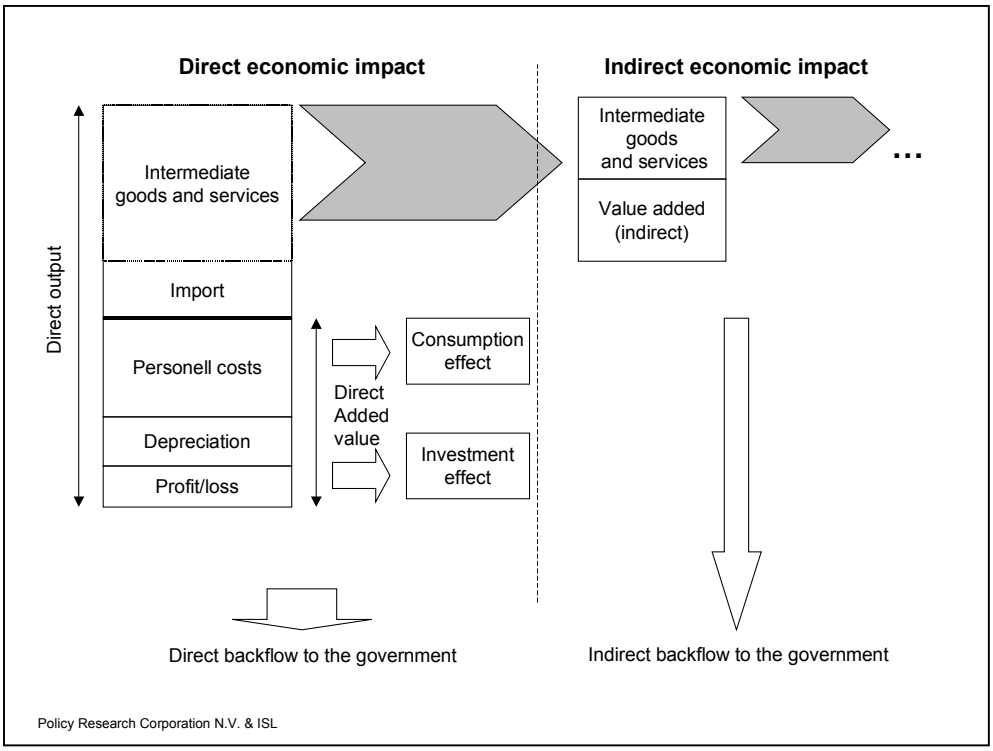

Figure 65: Direct, indirect and other economic impacts

The economic significance of the maritime cluster exists of the direct and indirect component. The direct component is generated in essence within the cluster itself. These activities generate however an indirect effect on the rest of the economy via purchases by maritime sectors from other sectors in the Netherlands. This indirect effect creates turnover, value added and employment in the supply-industry, which in turn creates an impact with their own suppliers, and so on. The indirect economic impact of the cluster on the rest of the economy is calculated with an input-output model. This is a quantitative model which has been constructed on the basis of the detailed cost-structures of the various sectors and companies within these sectors. As the existing statistical sources were not adequate to provide the thoroughness and detail of the 11 maritime sectors and 67 segments, a whole new bottom-up model, based on several thousands of questionnaires and interviews was made by the consultant in 1998 and 1999. A new assessment was made in 2003 in order to monitor

the cluster development over the period 1997-2002. The results of the research are summarised in the following figures of the *direct and indirect economic impact.*

The total production value in 1997 of the maritime cluster amounted to €20.3 billion; total value added amounted to €10.6 billion. During the five year period from 1997 – 2002 the total production value increased with 22 percent in current prices and the value added with 19 percent, see *Figure 66*.

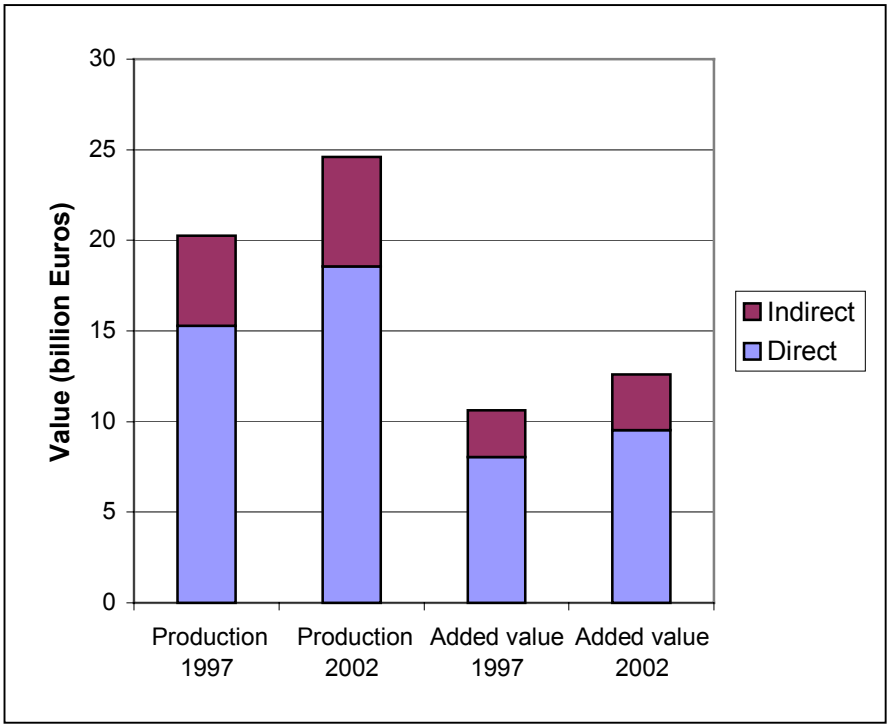

Figure 66: Evolution of maritime cluster, 1997-2002 [83]

The share of each sector in the total value added generated by the maritime cluster is shown in *Figure 66*. The value added, which is the sum of the labour cost, depreciation and profits, is largest in the Dutch ports sector (29%), followed by the offshore sector (13%). The other sectors, with the exception of the fishing sector have more or the less equal shares. The growth of the shipping sector is remarkable and shows the positive impact of the policy change which was implemented as off January 1996. The economic multipliers which generate the indirect effects in the Dutch economy are shown in *Figure 68* for the base years 1997 and 2002.

The cluster offers in the Netherlands direct employment to 135,000 persons and an additional indirect employment of 55,000 persons, see *Figure 69*. The ports and offshore sectors are the largest sectors. The direct employment of the shipping sector is relatively small, as foreign crew members on the Dutch flag fleet are not taken into account, as they generate no direct economic benefits in the Dutch economy. The export of the maritime cluster amounted in 2002 to 63% of the production value. This export quote is quite high as the Dutch economy as a whole exports on average 25% of the production. The largest exporter is the shipping sector with an export quote of 93%. The export quotes of each sector is shown in *Figure 70*.

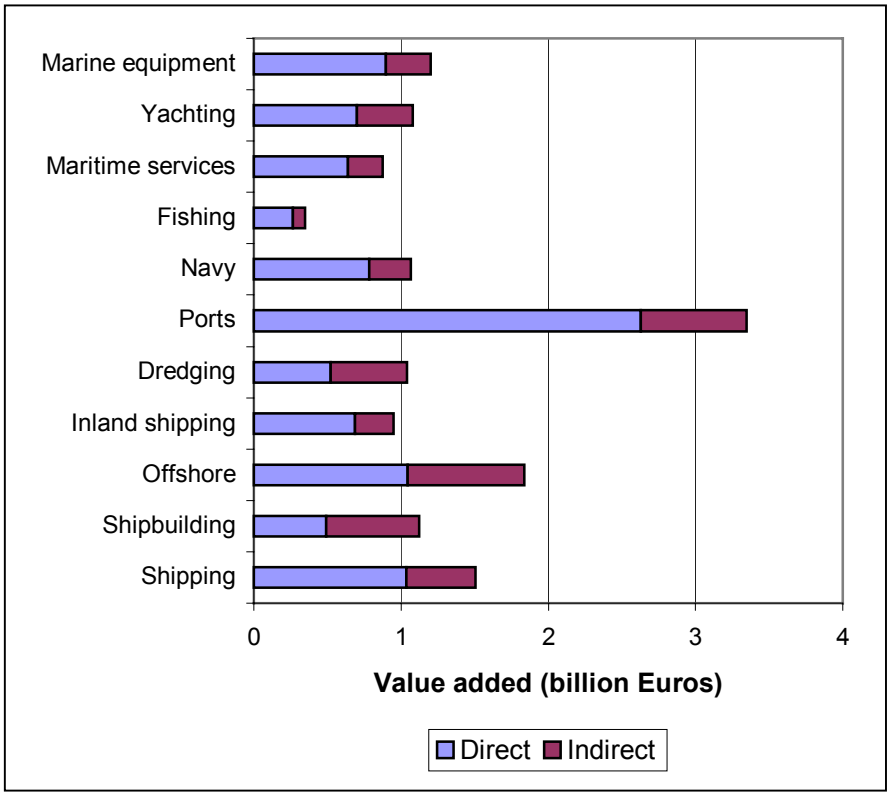

Figure 67: Value added, per sector, 2002

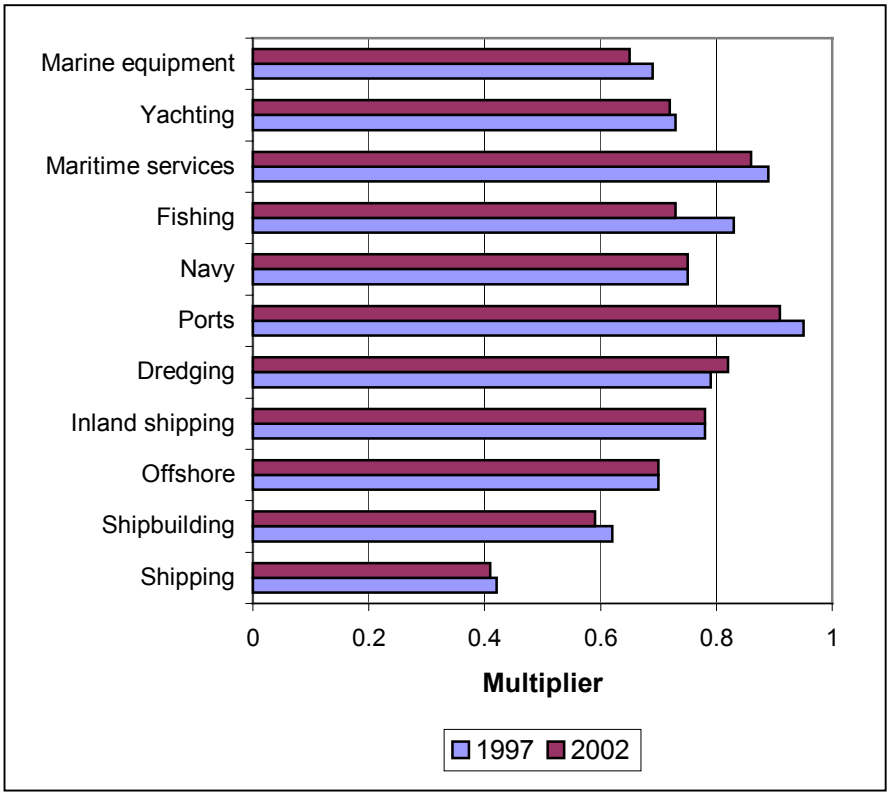

Figure 68: Economic multipliers

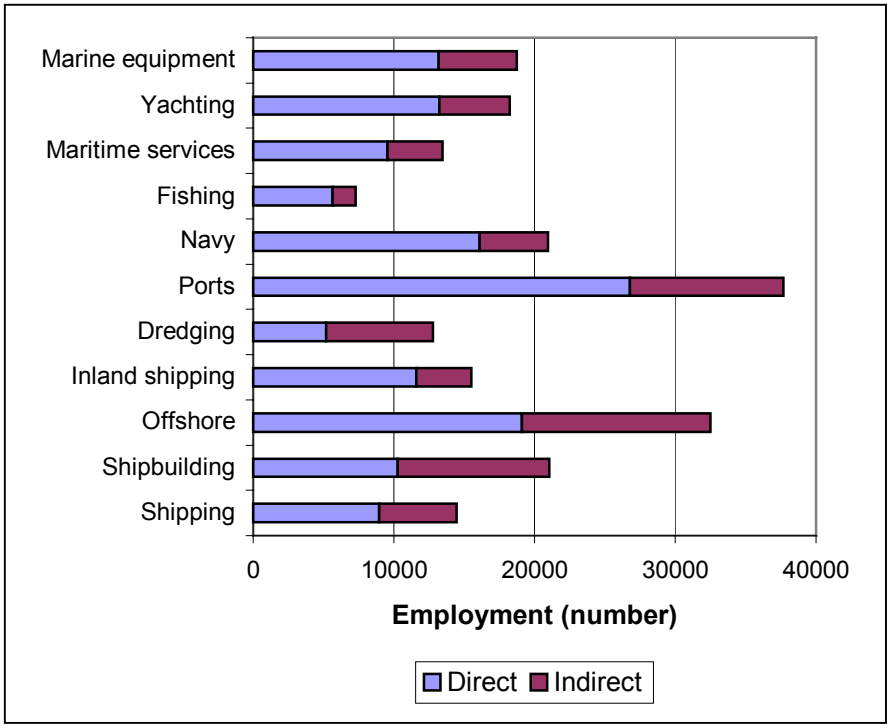

Figure 69: Employment, 2002

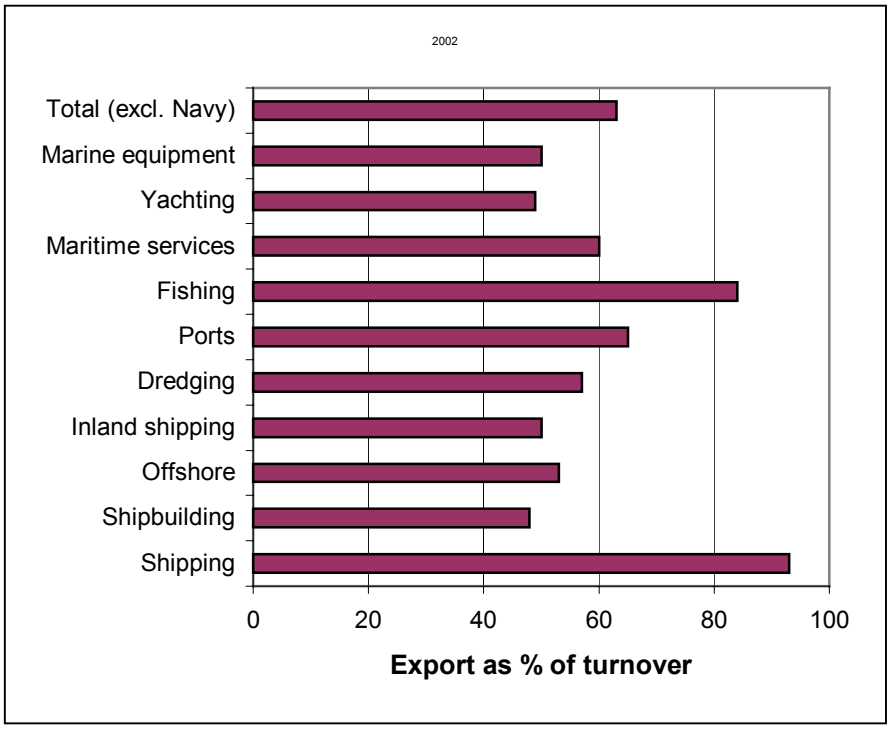

Figure 70: Export quote, 2002

An important indirect effect of the maritime cluster is the back flow to the government of social premiums from companies and employees, income taxes, corporate taxes and indirect taxes, like value added tax minus subsidies. The total black flow to the government in 2002 amounted to almost €4.5 billion as, *Figure 71* shows. The low share in the total back flow of the shipping sector is caused by the restitution of most of the social premiums to the companies as part of the new shipping policy. The ports sector is the largest contributor, which is not surprising given the employment number of this sector.

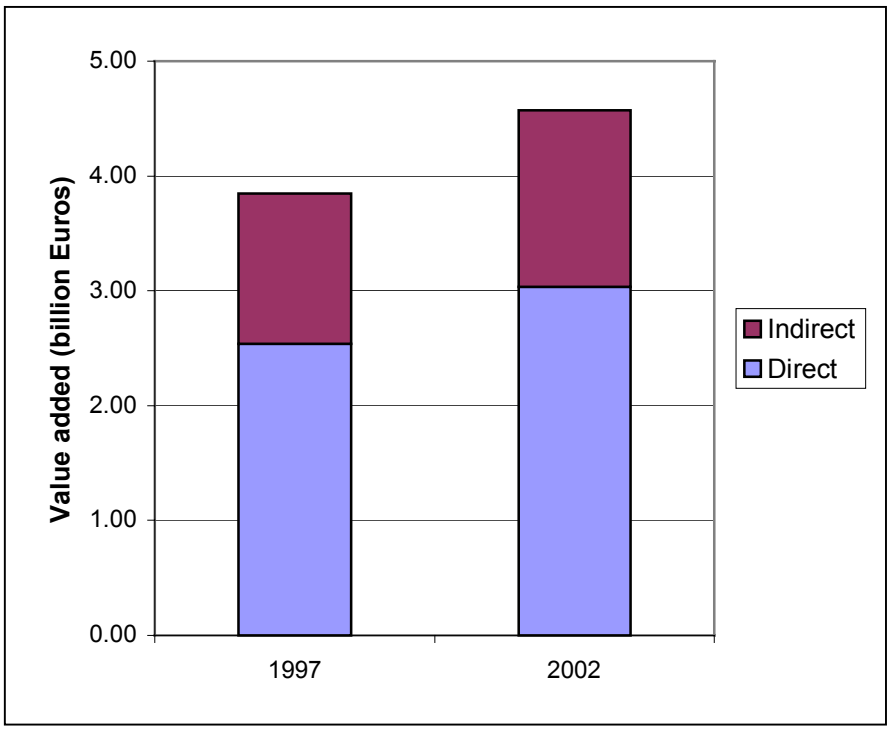

Figure 71: Back flow to the government

Economic cluster relationships and synergies

A cluster is in essence a group of sectors that are connected. The relationships within a cluster may differ from sector to sector. Some sectors reinforce each other and therefore create synergies. The dynamics are more than can be measured in simple economic terms. The economic relationships and synergies may help to understand the innate strength of sectors that are part of a cluster.

The total value added by the Dutch maritime cluster in 1997 made up 3.1 percent of GNP and its share in the country's exports is almost double that percentage: 5.5 percent. In 2002 this figures were slightly lower as the overall economy grew slightly faster than the cluster as a whole. Although the share in GNP and exports are very important figures to assess the overall economic importance of the maritime cluster for the Dutch economy, they do not prove that there is a real cluster of interrelated sectors which build its strength and dynamics on these unique relationships and synergies.

The relationships within a cluster can be grouped into vertical (buyer/seller) and horizontal (common suppliers, technology, etc.) relationships. The vertical

relationships are easier to quantify based on the input-output model which has been constructed from the cost-structures of the companies in each sector. From this empirical vertical analysis, the important horizontal relationships become clear as well as the importance of one sector for an other in terms of clients, suppliers, service providers, and technology.

The open character and relatively small scale of the Dutch economy makes the competitive position of the various maritime sectors to a large extent dependent upon the developments in the world markets. But also structural changes within the Dutch economy have an impact on the relationship with other sectors within the cluster. The unique combination of national economic relationships and a strong position in the home markets, give the sectors an important competitive advantage in comparison with foreign competitors. In other words, a strong position within the Dutch maritime cluster creates a strong basis for the eleven sectors to compete in foreign markets.

The diagram schematically shows the most important financial relationships within the maritime cluster. The purchase and sales of maritime products and services between the Dutch maritime sectors are schematically shown in *Figure 72* for the year 2002. It is remarkable that two sectors, marine equipment suppliers and maritime services, have supplier relationships with all the other sectors in the cluster. The shipbuilding sector is centrally placed in this diagram as it supplies ships to all the sectors.

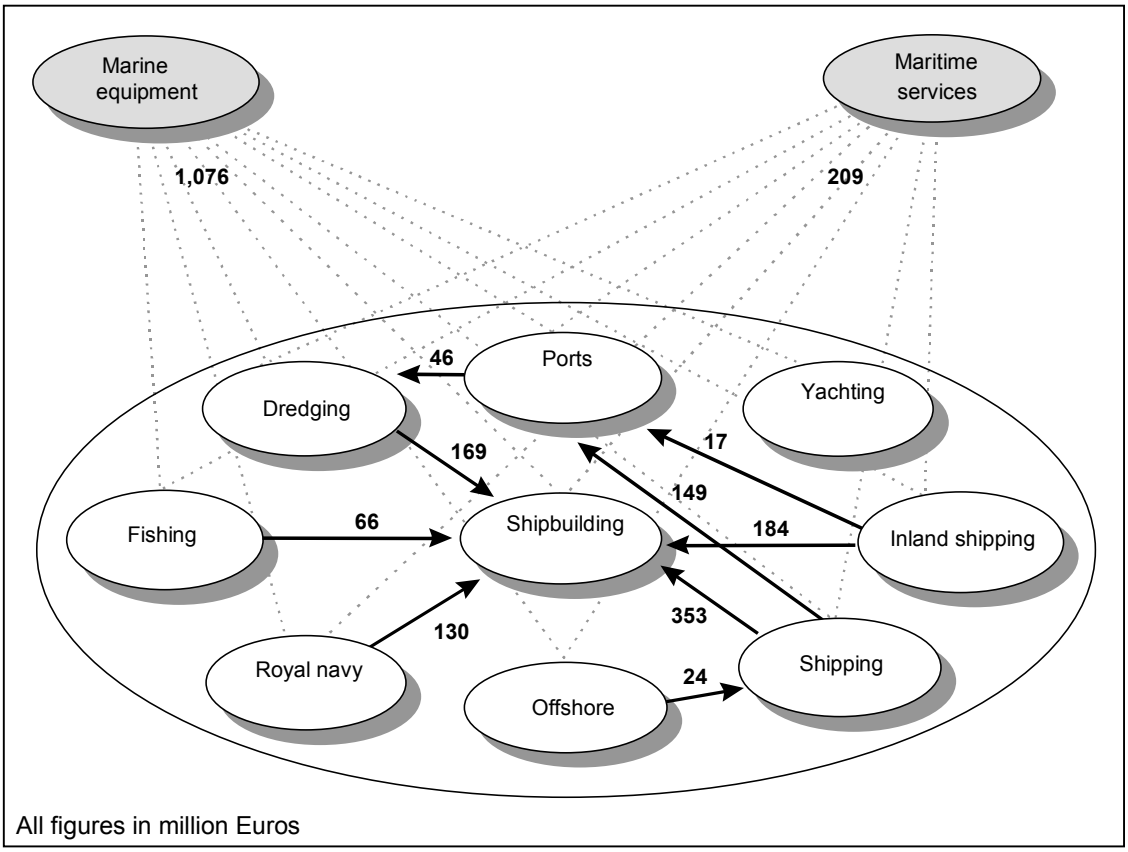

Figure 72: Financial relationships within the maritime sector

The diagram underlines that there are six sectors that drive the orders for capital equipment and are thus the drivers of the domestic cluster: shipping, dredging, inland shipping, navy, offshore and fishing. The shipbuilding and marine equipment sectors depend to a large extent on these domestic orders. The offshore sector buys mostly within its own sector. The shipping sector is also an important customer of the ports sector, and the ports sector is an important customer of the dredging sector.

Apart from the economic relationships there are also other common denominators within the clusters, like the labour market, maritime and nautical education, the research and development infrastructure, and so on. These aspects are also very important. The many studies into the maritime sectors and the cluster as a whole, made it clear that a true maritime cluster exists in the Netherlands and that the initial hypothesis has been confirmed. That is what the Dutch Maritime Network set out to do in the first place. The next step has been the formulation of new policies at the various levels to reinforce and promote the maritime cluster and that is the subject of the following paragraph.

6.4. Cluster policies

The objective of the broad and in-depth Dutch Maritime Network study, was to arrive at policy recommendations which would lead to a lasting and dynamic growth of the maritime cluster. Not through direct interference with the market forces, but by creating the conditions, or rather the framework, within which the private sector could function best. Reinforcing its innovative capacities and its capacity to create sustainable value added and employment for the Dutch economy.

This policy framework for the future was based on a conceptual model, or paradigm, in which entrepreneurial spirit and responsibility were the central pillars. This spirit is based on and can be reinforced by having highly qualified people (human capital), an innovation driven R&D and innovation diffusion network, and sufficient (risk) capital. Through intensive co-operation within the cluster, its effectiveness and growth can be increased. At the same time the government should support vigorously exports from the cluster and look after the safeguarding of a competitive level playing field within the various world markets. Against this background, the consultant proposed a number of policy measures at the various levels which are discussed in the following paragraph.

Policy analysis

The recommendations were focused on ten themes: innovation, export, home market, infrastructure and spatial planning, modal shift, level playing field, capital market, network and image building, labour market and education, dialogue government - private sector. These ten themes will be briefly discussed. The board of the Dutch Maritime Network has used these recommendations to define and set its own priorities. The progress on the various policy themes since then, will be discussed in another paragraph.

Innovation

This is the durable driving force behind continuity and growth of the sectors within the maritime cluster. Innovation is a prime responsibility of the entrepreneurs, but the government has created, as in any industrialised nation, a number of generic instruments to stimulate innovative behaviour and the innovative capacity of people and companies. *The questions that arise are: how innovative is the maritime cluster currently, what kind of instruments would be most effective, how can the innovation diffusion process be organised within the maritime cluster?* The answer to the first two questions was found in follow-up studies commissioned by the Dutch Maritime Network. The consultants proposed to set up a Maritime Innovation Forum to strengthen the innovation networks between the sectors and the maritime cluster as a whole. In this Forum the participating trade organisations could co-operate and initiate cross-sector innovation projects.

Export

This is the most important factor to achieve the growth ambitions of the cluster, as the home market of the Netherlands is very limited in size. The export quote of the cluster, excluding the navy, is already 60 percent, with variations between sectors. *Which measures and existing instruments from the government agencies may increase the export quote even further?* Apart from a number of specific issues, the consultant recommended to set up the Maritime Export Forum in which the participating trade organisations could define joint export initiatives and create critical mass in their actions, especially for the development of new export markets.

Home market.

Not only export is important for the future growth of the maritime cluster. A strong, dynamic and competitive home market with excellent location factors is also important. Shipping is of paramount importance for the shipbuilding industry, and this sector is in turn crucial for the marine equipment suppliers. The Dutch government has proved that it is able to take daring measures to safeguard the home market and level playing field of the shipping sector, through the innovative measures implemented in 1996 as part of the new shipping policy. These simple, administrative measures, which saved a lot of direct subsidies to support the Dutch flag, should be regularly updated as many countries have imitated these policy measures. At the same time the government should initiate similar actions in other sectors, like in the offshore sector (marginal fields policy). Experimentation in the home market can be done rather autonomous, without complicated and time consuming international consultations. The consultant recommended to monitor these home market triggers, not as part of a lobby effort, but rather as a means to maintain the internal, home market dynamics and create a (at least temporary) competitive advantage.

Infrastructure and spatial planning

The competitive position of Dutch ports, shipping and inland shipping, as well as dredging, depends to a large extent on the infrastructure and spatial planning policy of the government. The transport policy is of course crucial for these sectors. The consultant noticed that a large number of projects that might strengthen these sectors

in an integral way, were constrained by the lack of funds to finance these often large infrastructure projects. It was proposed to set up public-private partnerships which could help speed up the construction of these projects and at the same time improve the competitive position of a number of maritime sectors. This theme is in fact linked to the previous issue, home market. The constant upgrading of the national maritime infrastructure is a condition for the maritime sectors, to develop innovative technologies which can be exported, or which improve the structure and competitiveness of the Netherlands in the international transport chains, the basis of its past success and growth.

Modal shift

The pressure on the road transport system increases to unacceptable levels, not only in the Netherlands, but also in Europe. The Dutch government has taken various measures to promote the shift from road transport to inland shipping, rail and short sea shipping. A new policy, aimed at a massive shift within Europe could mean a tremendous stimulus for the various sectors. The consultant proposed a number of measures to help shippers and receivers of cargo to support this modal shift and to reward it financially.

Level playing field

Governments often tend to protect their own economy against foreign competition. Although there are enough countervailing powers within the EU, the OECD, or the WTO, there are many ways to hide the protection. The Dutch economy has always been very open in comparison with many other countries, and the government is not eager to get involved in subsidy races. However, fair access to foreign markets is a key-element for the international maritime economy. The collective EU WTO-complaint against South Korea is such an example.

The new Dutch shipping policy of 1996 created a level playing field for the Dutch shipowners, and the impact has been enormously positive for the Dutch economy and the maritime cluster as a whole. The consultant proposed to set up a sort of Dutch watchdog maritime market monitor which could signal and investigate complaints of Dutch companies regarding forms of unfair competition and distortion of the level playing field.

Capital market

Access to risk capital is often difficult for smaller entrepreneurs in the volatile maritime markets. The consultant proposed some specific measures to stimulate the capital flows for investments to the SMEs, like loan guarantees or fiscally attractive shipping investment structures. It was also proposed to set up a Maritime Capital Forum.

Network and image building

The lack of cohesion and the fragmented nature of the maritime cluster has been the reason for the foundation of the Dutch Maritime Network organisation in mid-1997. The first initiatives from this small group of professionals which formed its board,

were concerned with the creation of an independent maritime platform, which would strengthen the interaction between the various sectors and to take initiatives to improve the non-image of some of the sectors with the general public. In the past this had been tried before, but the initiative from five trade organisations failed rather fast. The independent Dutch Maritime Network started out with a limited number of participating trade organisations, but increased its base step by step when it became evident for the outside world that the organisation could add value to the cluster. Actually, one of the main achievements has been that the maritime sectors realised that they were part of a very big maritime cluster of which one could be proud, given the world class of its companies and its important role in the Dutch economy. The consultant proposed that the organisation of the network should get a higher public profile and that it should help the trade organisations to strengthen their ties and activities.

Labour market and education

The availability of a sufficient and well qualified labour force is a condition for the growth and the continuity of the maritime cluster. There are a number of serious bottlenecks in the Dutch labour market in general, as well as more specifically in the nautical and maritime professions. The shipping sector faces severe shortages of qualified officers, a problem which has grown bigger as a result of the success of the Dutch shipping policy and the growth of employment on board the Dutch flag fleet. But these problems tend to spill over to other sectors like dredging in the short-term, but to the entire cluster in the long-term, as many nautical and maritime educated workers find their way in some of the 135,000 other jobs in the maritime cluster. In order to address these problems, the consultant made a number of generic and specific recommendations to open up the possibility of employing more foreigners (shipping, and inland shipping) and to create more flexible working arrangements. Apart from that the promotion of maritime professions and education should be reinforced.

Dialogue government – private sector

The final theme of the policy analysis by the consultant concerned the formal structuring of consultative procedures between the maritime cluster and the government, as well as the creation of a mirror policy cluster organisation of the Dutch Maritime Network within the government and between the seven ministries which are directly involved with the maritime cluster. The integral approach to problem solving and networking by the private sector is not at all matched by the vertical organisation of the ministries. A cluster on that side might generate major benefits.

On the basis of the detailed input-output model of the maritime cluster, which was part of the study, the policy recommendations were translated into quantitative scenarios for the years 2005 and 2020. The model and the scenarios have been published as well. The short-term scenario of 2005 demonstrated that reinforcing innovation, export, modal shift and level playing field contributed most to the additional value added of the cluster. In the longer term scenario the most important impacts on the growth of the cluster were triggered by the same variables, including infrastructure. The long-term impact of the proposed measures was that the autonomous growth of the

maritime cluster of 1% per annum, would be minimally increased with 1% per annum. In itself these are not spectacular outcomes, but it shows that even with an additional effort in many domains, the cluster can compensate for the autonomous growth of productivity of this period and the corresponding decreasing value added.

Policy choices

Based on the study with policy recommendations, the trade organisations participating in the Dutch Maritime Network were asked to comment. Their reactions and suggestions were used by the board of the Network to set its priorities. There were a number of general criteria which the board used to evaluate the recommendations. For example, the recommendation should be:

- Broad, encompassing a number of sectors;
- Pre-competitive and not distort the market place;
- Focused on the core-business of the maritime cluster;
- Involve the trade organisations;
- Implemented independently and require little financial means;
- Get the (moral) support of the ministries;
- Not against international rules and regulations.

The board decided that the future activities should be focused on four themes, which it deemed crucial for the future of the cluster. These themes were:

- Communication (incl. image);
- Labour market and education;
- Export;
- Innovation.

The remaining five policy themes were also judged to be important, but outside the span of control of the Dutch Maritime Network. This were the themes: home market, infrastructure and spatial planning, modal shift, level playing field, capital market.

The four themes were consequently organised in forums. Each forum has a membership of the relevant trade organisations and reports to the board of the Network. A great many projects have been initiated, but it would lead too far to go into all the details.

6.5. Agenda for the future

The agenda for the future of the Dutch maritime cluster is based on a number of key-drivers. These are: the global market, exports and internationalisation of companies, the opportunities at home and the attractiveness of the Netherlands for investments, the availability of a well-educated workforce and flexible labour market, the innovation climate and research and development, the level playing field, the cluster synergies, and, last but not least, Europe.

Growing world markets are the main drivers for all the maritime sectors. From this perspective the maritime industries are part of global growth markets. The challenge for the Netherlands is to grow with the market or to expand its market share.

Given the small home market of the Netherlands, exports is the most important way of increasing value added. The current high export quote of the maritime cluster of 63% will probably increase the coming years to a level of 70%, but at the same time internationalisation of companies and their activities abroad will result in a gradual structural change of the cluster. This will result in a relatively stable level of Dutch employment, and a growing workforce abroad of non-Dutch people. Currently it is estimated that 34,000 foreigners work in Dutch owned maritime companies abroad. The more international the companies become with respect to outsourcing of production and engineering in Eastern Europe and Asia, the more their investments will be directed to these growth markets. This means that the Netherlands as a country has to compete more intensively for investments, as international leader firms have more than one choice for the allocation of their scarce resources.

The fact that the Netherlands has a strong and internationally oriented maritime cluster, proves de facto that the country is an attractive location for maritime investments and companies. Maintaining this position also requires an outward-looking government, which is aware of the global competitive situation. Besides, companies should be facilitated to expand where possible, at home. A strong home market remains one of the key-competitive factors of any sector. Rigid procedures, like in spatial planning or environmental permits currently stifles the cluster dynamics. These issues have to be addressed if the Netherlands wishes to maintain a prominent maritime position in Europe and the world.

Maintaining a level playing field is of the essence in an era of rapid globalisation. A vision of the future, translated into an industrial policy by the government is a prerequisite for collective actions, when other countries do not respect the rules of the competitive game, as is the case in shipbuilding. But also access to markets is high on the agenda, as for example the protective measures in the USA. Dutch maritime companies are able to defend their turf when a level playing field exists, as the new shipping policy has demonstrated.

Maritime knowledge, expertise, education and research and development are essential for the level of innovation and the innovativeness of the companies. Maintaining critical mass is important in view of the transfer of many production and engineering jobs from the Netherlands to other countries with lower factor costs.

The strength of the Dutch maritime cluster is build on the strength of the eleven individual sectors which make up the cluster, but also on the synergy between the sectors. Therefore, it is of vital importance that certain sectors are defended when unfair competition threatens the survival of a sector, as is the case with shipbuilding. An active cluster policy which builds on the strength and reinforces the dynamics of the cluster as whole, is an important element in the agenda for the future.

Capitalising on opportunities, for example in short sea shipping or the replacement of small tankers, requires a collective action at the European level. But an European policy is also crucial in other domains. A strong maritime Europe is an important factor for the future of the Dutch maritime cluster as a large share of the exports are directed towards European countries. This is an important reason why the Netherlands, but also other European countries should invest in the creation of a European Maritime Cluster Policy.

7. THE MARITIME CLUSTER OF NORWAY

7.1. Introduction

A brief introduction to the maritime history of Norway

Archaeologists have found evidence of shipping in Norway dating back to the Stone Age (1500 BC to 500 BC). However, there are also findings that indicate that there has been shipping long before this period of time. The early seamen were probably hunters, but there is evidence of trade dating back to the Bronze Age. The first sailboats were constructed in Norway around year 700 AC. The Vikings (from about AD 800) introduced the specialisation of merchant and war ships. During the first centuries after the first millennium, trade and shipping grew rapidly, with the Hanseatic city of Bergen as the centre. The Norwegian export consisted of products such as whetstones, cod-liver oil, fur, tar and timber. The imports included products such as beer, wine, bread, metals and jewels.

During the industrial revolution in the 19th century the Norwegian shipping industry went global. This period also gave birth to modern-day specialised tonnage such as passenger ships, cargo ships and tankers. World War I hastened the end of the sailing ship era for Norway. During the war almost half of the fleet was lost. After a boom in shipbuilding and a collapse in freight rates during the first years after the war, the economy started to pick up in the middle of the twenties. Stimulated by aggressive ship brokers the Norwegian shipping industry entered into oil transport. By 1932 the tanker fleet had grown to 1.5 million gt, which was more than a sixth of the world fleet. At that time, the fleet also included specialised ships. The Norwegian fleet grew strongly until the outbreak of World War II. During the war nearly half the fleet was destroyed. After the war, the maritime industry went through a period of growth and many specialised trades were pioneered by Norwegians (e.g. parcel tanker trade).

During the years after the 1973 oil crisis the Norwegian shipping industry has gone through a period of major transition. Aggressive competition from low-cost countries in Asia, has put a lot of pressure on the Norwegian fleet. The global shipping market was, since the early 1980s, characterised by overcapacity. Norwegian ships where flagged out and the crews were replaced by cheaper foreign seamen. The change started in 1987 with the introduction of the Norwegian International Ship Register (NIS). The new register allowed Norwegian shipowners to employ foreigners with salaries agreed upon in their home countries. This made it more attractive for shipowners to register ships in Norway. It created a better level playing field for many Norwegian registered ships in the international market. From 1986 to 1991 the Norwegian registered merchant fleet grew from 24 million dwt to 55 million dwt. In April 1991 917 ships were registered in NIS alone. During the recent years the number of ships seems to have stabilised at around 750 ships. There is still a very high number of Norwegian controlled ships under foreign flags.

Another important event that increased the speed of the recovery, was the introduction of the 1996 tonnage tax reform. The tax was harmonised with countries such as the Netherlands and Greece. Instead of taxing shipping companies on their income, the companies are since 1996 taxed on the tonnage of their ships. The fleet registered by the Norwegian Shipowners' Association grew from 1393 ships in 1996 to 1718 ships in 2001.

The competition in shipping has increased much and the increasing competition will force shipping companies in high-cost countries to emphasise innovation even more strongly than today, in order to survive and grow in the global markets. If such change does not happen, it might have a considerably negative effect on the growth of the maritime industry [23].

Even though the Norwegian shipping industry is still heavily involved in low-technology sectors, such as oil transportation, the industry has become more and more specialised, with a high degree of differentiation of its services. Differentiation implies that the shipping firm offers specialised services. *Table 30* shows the sectoral growth of Norwegian shipping from 1974 to 2001.

	1974	1988	2001	Growth 74-01	Growth % 74-01
Passenger ships and ferries (gt)	350	566	1,136	786	225
Tankers	21,470	14,317	29,057	7,587	35
Combination ships	7,545	4,464	4,155	-3,390	-45
Bulk ships	9,385	7,305	11,004	1,619	17
Other dry cargo ships	3,190	1,870	5,066	1,876	59
Offshore services ships		324	737		

Table 30: Sectoral growth in Norwegian shipping (*1000 dwt) [10][93]

Table 30 reveals a shipping industry that is heavily involved in sectors where differentiation is vital (mainly passenger ships, other dry cargo ships and offshore service ships). The table also shows that the growth rate is highest in the advanced sectors. For offshore service ships there are no numbers available for 1974. However, from 1988 to 2001 the fleet of offshore service ships has doubled. It is also important to point out that the group aggregation hides important information concerning specialisation. Norwegian shipowners have focused on specialisation, also in the segments of standard tonnage [128]. This implies that differentiation is important in most sectors of shipping.

Although the population is only 4.5 million, the total trade accounts for one percent of the global trade and today the fleet accounts for about ten percent of the world fleet [122]. Norwegian shipping companies control over 1700 ships over 100gt. that operate in international trades (or 15.6 million dwt.). Over 18,000 Norwegians and more than 48,000 foreigners are employed on Norwegian-owned ships and offshore rigs [94]. Norway has been one of the world's leading shipping nations for 150 years. Today the maritime industry accounts for almost seven percent of the total value creation in Norway [39].

Illustration 3: Frontline and Farstad Shipping

Frontline has the world largest fleet of tankers and is a good example of a vital Norwegian-controlled company within a traditional low differentiation shipping segment. Its fleet consists of 32 Suezmax tankers (8 are Combination Carriers) and 41 VLCC tankers (including newbuildings). This fleet has a total size of 17 million deadweight tonnes (30-4-2003). Before 1996 Frontline was a Swedish company in the OBO trade (large combination ships). In 1996 ship owner John Fredriksen bought the majority of the company and listed it on the Oslo stock exchange. Soon after the take-over, Fredriksen started to expand the company by both friendly and hostile acquisitions.

The complete strategy behind the growth of Frontline is not known. However, the acquisition and growth is linked to a desire to build a solid and strong (consolidate) tanker company through increased market power (large and flexible fleet), reduced uncertainty, economy of scale, long-term relationships with equity investors and reducing the extreme cyclical pattern of the oil tanker trade. Frontline seems to be consistent with its strategy

Farstad Shipping, founded in 1973, by the Farstad family is an example of a differentiated company operating in the offshore service segment. It was one of the pioneers in the North Sea offshore market. From 1988 it has been a public traded company, listed at the Oslo Stock Exchange. Farstad shipping is an integrated company, with its own management activity. Its head office is in Ålesund on the northwest coast of Norway. However, the activities are also managed from Aberdeen in Scotland, Macea in Brazil and Melbourne in Australia. The importance of the North Sea market is decreasing. Farstad Shipping has about 60 employees onshore and about 1000 sailors. The operating income in 2002 was €41 million and the profit was €9 million.

Farstad's fleet consists of anchor handling platform supply vessels supporting offshore activities in the North Sea, in Brazilian waters, in Australian waters, and offshore Vietnam, Malaysia and the Philippines. The fleet consist of 44 vessels and 8 vessels are under construction. 28 vessels and one newbuilding are wholly owned by Farstad Shipping. 15 vessels and four newbuildings are owned by a joint venture with P&O (Australian), named International Offshore Services (IOS). The remaining three newbuilding are owned by Brazilian Offshore Service (BOS), a joint venture with Petroserv in Brazil.

The maritime cluster

Table 31 shows the most important sectors in the Norwegian maritime industry. It shows that shipping companies form an important part of the maritime industry. However, the Norwegian maritime cluster includes many industries and is complex. Many maritime sectors are represented, but no formal sectoral structure of the industry has been established, like in the Netherlands.

Industry	Number of companies
Shipping companies	2,501
Ship building and repairing	456
Ship broking	332
Shipping consultants	106
Shipping equipment and engines	65
Other shipping industries	306
Other shipping services	287
Total	**4,053**

Table 31: Maritime industries and number of companies [5]

In 1998 shipping companies formed 61.7 percent of the total number of companies. This percentage gives an indication of the importance of these companies for the

maritime industry. A detailed overview of the categories based on the NACE-classification is given in *Appendix 1b*. In addition to the seven categories given above, the following categories also form an important part of the maritime industry in Norway:

- Shipping insurance and finance;
- Shipping research and education;
- Classification services;
- Fishing;
- Off-shore;
- Shipping authorities.

Although Norwegian researchers often state that the Norwegian maritime cluster is complete [96], there are maritime sectors that are small. Compared to the Netherlands, sectors such as dredging, inland shipping, and navy are minor sectors. Yachting (or leisure boats), ports and navy are not included in most analyses of the maritime sector in Norway. As *Table 31* indicates, Norwegian maritime industry is dominated by the shipping sector. Around 50 percent of the value creation in the maritime industry is within shipping companies. The rest of the cluster is almost equally split between services, equipment and ship building [39].

The description of the size of the maritime industry in Norway depends upon which sectors are included. Normally, the definition of the maritime industry is based upon internationally recognised industry codes (NACE-codes). However, this does not always reflect reality very well. In order to give a fair presentation of the maritime cluster, it is important to consider all companies that create the dynamics of the industry.

Based on interviews with 33 key informants in the maritime industry and analysis of secondary statistics, a profile of the strength of key parts of the maritime industry was drawn [10]. The profile is made by ranging the sector's strength from one to five (*Table 32*).

Industry	Strength
Shipping companies	4
Ship building	2
Marine equipment	3
Technical services	5
Financial services	4
Capital	2
Research and education	4

Table 32: Profile of strength of key parts of the maritime industry

The researchers compared Norway with Greece, Great Britain, Japan, South Korea, Singapore, China/Hong Kong and the United States. They argue that Japan has the most complete maritime cluster (high score on most sectors) with Norway as a clear number two. There might have been some changes in this picture since 1995.

Maritime network organisations

There are many organisations supporting the maritime industry in Norway. Several organisations have been established in order to represent the interests of employers and employees within the maritime industry. For instance, the Norwegian Shipowners' Association represents shipping- and offshore related businesses. The organisation was founded in 1909 and organises a majority of shipping companies in Norway. There are also other organisations representing various business segments such as the Norwegian Shipbrokers' Association, and there are several labour unions representing various groups of employees.

The Maritime Forum, founded in 1990 is the only real network organisation and it aims at strengthening co-operation between the different sectors and players within the maritime industry. The organisation also aims at influencing the condition of maritime industrial policies and works for the interests of the maritime industry on an international level. Through the participation in the European Maritime Industries Forum (EMIF) Maritime Forum seeks to strengthen the international competitive advantage of the European maritime industry.

The Maritime Forum has several hundred members, comprising both employers and employees of maritime organisations. The headquarter is located in Oslo. While the Dutch Maritime Network has divided the network based on sectors of industry, the Maritime Forum has established relatively independent departments within the most important regional maritime clusters in Norway.

The Maritime Forum spearheads several joint projects within the maritime cluster, in order to develop new business opportunities. In co-operation with the Norwegian Research Council, the Maritime Forum coordinates maritime EU research activities. The Maritime Forum, also, arranges international marketing excursions and plays a part in larger promotional campaigns for the industry it serves. Although the Maritime Forum is important, it only has a small staff (four at the headquarter) and its budget is limited.

7.2. Economic growth

Growth from 1988 to 1999

There have been several studies during the past twenty years that focused on cluster characteristics and competitiveness in the Norwegian shipping industry. *Appendix 1a* gives an overview of the major studies. In some of these studies the economic growth of the maritime cluster has been analysed. This book provides the most important numbers from these studies, which gives a picture of the maritime sector in Norway.

Especially two groups of studies have analysed the size and structure of the maritime industry in Norway. The projects named *The Value Creating Norway* [5][96] and the *Regional Maritime Norway* [32] applied different methods in order to measure the cluster. In both the studies, the turnover and value creation are used to estimate the size of the maritime industry (gross value creation = wages plus depreciation plus

profit before interests and tax; net value creation = wages plus profit before interests and tax).

The value creation project used a categorisation based on the NACE-codes. This categorisation includes the eight sectors shown in *Table 30* (the details of the codes included are shown in *Appendix 1b*. The numbers in the regional project are based on a sector definition, including all companies that create the dynamics of the maritime industry in each region. This was done in order to enable studies of the complete value creation systems in each region (the method of defining the maritime clusters in the regional studies is provided in *Appendix 1c*.

The results in both of the projects show a high growth rate for the maritime industry. However, the size and growth are different in the studies. The numbers are provided from material used in the value creation project and in the regional study [5][32]. The data in these projects are from 1988 to 1999. There also exists information on the value creation for 2000 and 2001, which will be presented below. However, these data cannot be directly compared with the data provided in the following graphs.

Figure 73 shows that the value creation according to the standard industry codes has grown from €1.3 billon to €3.7 billion. The turnover grew in the same period from 5.7 billion to €16.3 billion.

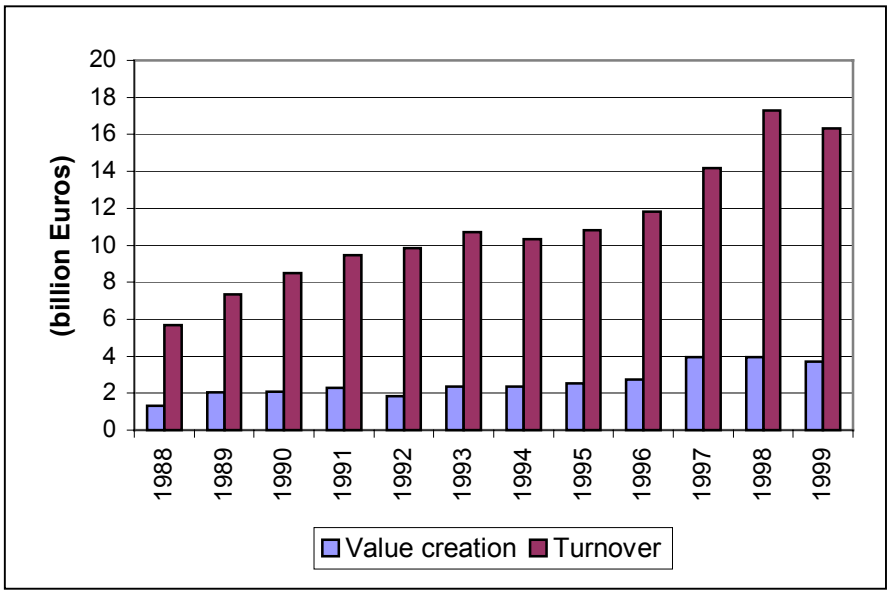

Figure 73: Turnover and value creation (based on industry codes)

The value creation according to the regional cluster definition grew, as *Figure 74* shows, from €1.5 billion to €6 billion, while the turnover grew from €6.1 billion to €24 billon. The growth in turnover and value creation of the two cluster definitions is very different. The differences in turnover are as follows:

- Growth in turnover based on the NACE-codes, 1988-99: 187%
- Growth in turnover based on cluster definition, 1988-99: 293%
- Growth in turnover for all Norwegian industries, 1988-99: 150%

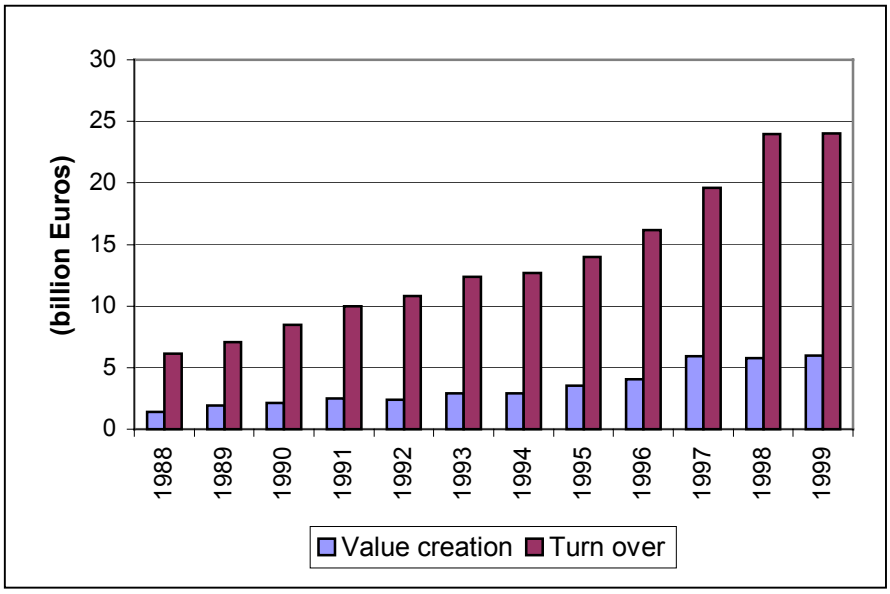

Figure 74: Turnover and value creation (based on regional cluster definition)

Based on these numbers, the average nominal growth in turnover for the maritime industry is 15.6 or 24.4 percent, dependent upon which sector definition that is applied. For all Norwegian industries the annual growth rate is 12.5 percent.

The differences between the studies for value creation are similar to the differences in turnover. The total net value creation was in the project called *Value Creating Norway* estimated at €3.46 billion in 1999. In the project *Regional Maritime Norway* the net value creation was estimated at €6.12 billion. This means that:

- Growth in net value creation based on the NACE-codes, 1988-99 is 184%
- Growth in net value creation based on cluster definition, 1988-99 is 324%

The growth in gross value creation, according to the definition used in the project *Value Creating Norway*, from 1988 to 1999 represents a annual average of 29.5 percent growth.

One important difference between the two studies, relates to the offshore industry. This industry has also grown substantially since 1988. As will be shown, one of the three regions with the highest growth in the maritime industry is the southern Rogaland, which is dominated by the offshore industry. However, the total growth of the Norwegian gas and oil cluster from 1988 to 1998 is lower than the growth of the maritime cluster [96]. This does not necessarily imply that the growth of the offshore supply industry included in the regional study has grown at the same pace as the whole oil and gas sector. The necessary data to make a final conclusion on this issue are not

available. Also, in the study on the regional maritime industry, the companies include only those companies that existed in 1999. Companies that where closed between 1988 and 1999 are not included. This means that the numbers in the regional study might be over estimated.

Economic development until 2001

The benchmarking project gives, as mentioned before, some numbers for the value creation in the years 1998 until 2001 [39]. The average value creation is estimated at approximately €4 billion. However, the definition used in the collection of these data is not directly comparable with any of the data given above. The annual growth of the value creation between 1990 and 2001 is estimated at *6.6 percent*. The relative importance of the maritime industry, measured as the share of the GDP, is estimated at almost 3 percent [39].

The profitability of the maritime sector has, according to the benchmarking project, been above the average profitability of Norwegian companies. Between 1990 and 2001 the return on asset was 7.1 percent for the maritime sector and 6.8 percent for all Norwegian companies. Also, the solidity of the maritime industry is high and is 43 percent higher than the national average between 1997 and 2001 [39].

Illustration 4: Norwegian International Ship Register

During the shipping crisis of the 1970s the Norwegian shipping industry started to face aggressive competition from low-cost countries in Asia has. Norwegian ships where flagged out and the crew where replaced by cheaper foreign seamen. The shipowners felt it increasingly necessary to use foreign registration as a means for remaining competitive. By 1986, the tankers and bulk carriers under Norwegian flag, were reduced by 33% and 43% respectively. The Norwegian International Ship Register (NIS) was established by the Norwegian authorities in 1987 as an instrument to halt the reduction of the Norwegian fleet and thereby maintain Norway's traditional maritime infrastructure.

The purpose of the register is to keep shipping companies under the Norwegian flag by providing a better competitive condition for the merchant fleet in worldwide trade. The new register allows Norwegian ship owners to employ foreigners with salaries agreed upon in their home countries. This made it more attractive to have ships sailing under the Norwegian flag. From 1986 to 1991 the Norwegian registered merchant fleet grew from 24 million dwt to 55 million dwt. In spring 1991 917 ships were registered in NIS. Currently there are 750 ships registered in NIS. There are still a large number of ships controlled by Norwegians under flags of convenience.

Export

According to OECD statistics including freight and passenger transport plus services directly related to the two groups, Norway's gross export was approximately 7.3 billion US$ in 1990 and 9 billion US$ in 2001 [74]. For the Netherlands the gross export, according to the same statistics, is approximately 8 billion US$ in 2001. Norway's net export grew from 4 billion US$ to approximately 5 billion US$ in 2001. In the Netherlands the net export was close to zero in 2001. The relative importance of the sea transportation export has declined over the last 10 years and accounts for about 11 percent of the total export in 2001. In the survey on maritime clusters in five European countries, it was found that Norwegian maritime firms have an average

degree of internationalisation [39]. This partly seems to contradict the OECD findings and might be due to differences in the sector definition or weakness in the response rate of the survey.

7.3. Regional concentration

As will be further discussed, the maritime cluster in Norway is not based in one region of the country. It is concentrated in different regions along the coastline. The circles on the Norwegian map in *Figure 75* mark the areas where there are regional concentrations of maritime industries.

Figure 75: Regional concentration of maritime industries in Norway

As the map shows, the maritime industry is concentrated in:

- The Oslo area;
- Vestfold, Buskerud and Telemark counties;
- Aust- and Vest-Agder counties;
- Rogaland county;
- Hordaland and Sogn og Fjordane counties;
- Møre og Romsdal county;

- The middle region of Norway.

There are, also, some maritime activities in the three northern counties of Norway. Thus, the industry in this part of the country is not concentrated in a specific area.

Figure 76 displays the turnover in the maritime regions in Norway in 1988 and 1999. The numbers are based on a sector definition, including all companies creating the dynamics of the maritime industry.

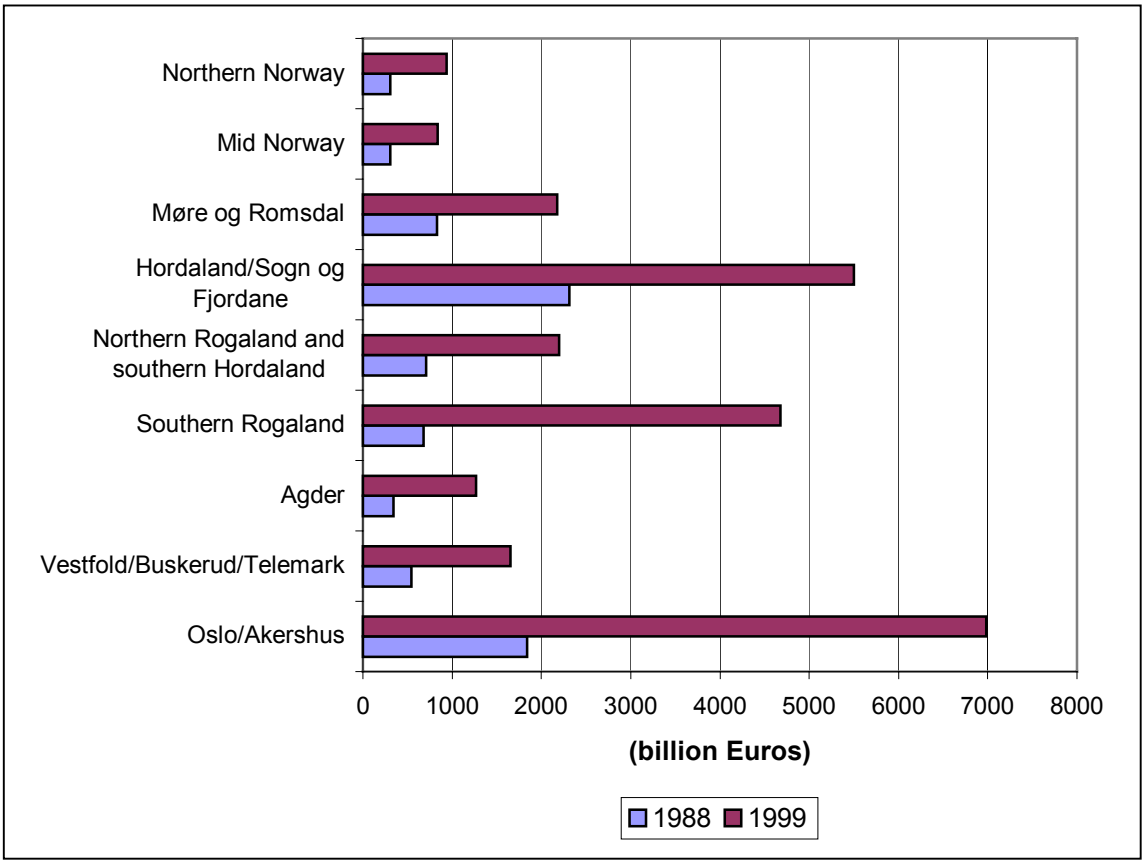

Figure 76: Value creation in maritime regions in Norway [12][31][32][49][50][59][76][95][105][117]

Figure 76 shows that the most important maritime regions are Oslo/Akershus, Southern Rogaland and Hordaland/Sogn og Fjordane. It also reveals that there has been a high growth rate in all regions during the eleven-year period. The highest growth has been in the southern Rogaland area, which is caused by the oil industry.

7.4. The national structure of the maritime cluster

Regional specialisation and national integration

During 2001 nine regional studies on the maritime cluster in Norway were conducted [12][31][49][50][58][76][95][105][117]. Based on these studies, it can be concluded that there is a growing regional specialisation. For example, the

- Oslo-area seems to specialise in knowledge intensive services, such as law, finance, brokering, classification, insurance, information, and communication technology (ICT). As Vestfold, Buskerud, and Telemark, the Oslo-area also has many shipping companies;
- Northern Rogaland and Sunhordaland at the west-coast, are specialised in offshore related activities and there are large suppliers for the petroleum industry located in this area;
- Southern Rogaland is specialised in petroleum-related activities and there is little left of traditional maritime activity;
- Møre og Romsdal on the northern west-coast, seems to specialise in ship design and shipbuilding;
- Mid Norway has a concentration of high-tech research and development, and technology intensive suppliers;
- Northern Norway has a considerable specialisation in sea fishing.

Parallel with the increasing regional specialisation, there is an increasing national integration of the maritime industry in Norway [32]. For instance, knowledge intensive suppliers in the Oslo region have connections with maritime companies throughout the country. Also, the worldwide-known classification company DNV, has many knowledge intensive relationships in all maritime regions. This is also the situation for several other knowledge-intensive and highly specialised organisations that have to sell services to more than one region. Finally, there is a variety of relationships between regions through suppliers and through co-operation related to knowledge intensive organisations. For instance, often the development of new production processes and services happens on a national level.

The linkages between the maritime industries

The strength of links within the maritime industry was measured on a scale from 1 to 4 [96]. 1 indicated no relationship and 4 indicated strong relationships (*Figure 77)*.

Firstly, *Figure 77* indicates that the shipping companies are the most central actors in the maritime industry. They are strongly related to most of the industries within the sector. Also, the classification services, shipping consultants, and shipbuilding have many strong and medium strong links to the rest of the maritime sector. *Figure 77* also indicates that the relationships between the industries in the same sector are strong, and it shows that there are strong relationships between what is traditionally labelled as shipping (shipping companies, ship brokerage services, insurance, bank/finance, classification, consultants, other services) and the shipping supply industry (ship building, equipment, engines, wholesale). There are especially strong relationships between shipping companies and the shipping supply industry.

Figure 77 also reveals that there are many weak relationships in the maritime cluster. This may reduce the upgrading mechanisms in the cluster. The relatively weak relationship between education, research and development, and the other sectors of industry within the cluster is a problem. However, this also creates opportunities for strengthening the cluster's upgrading mechanisms.

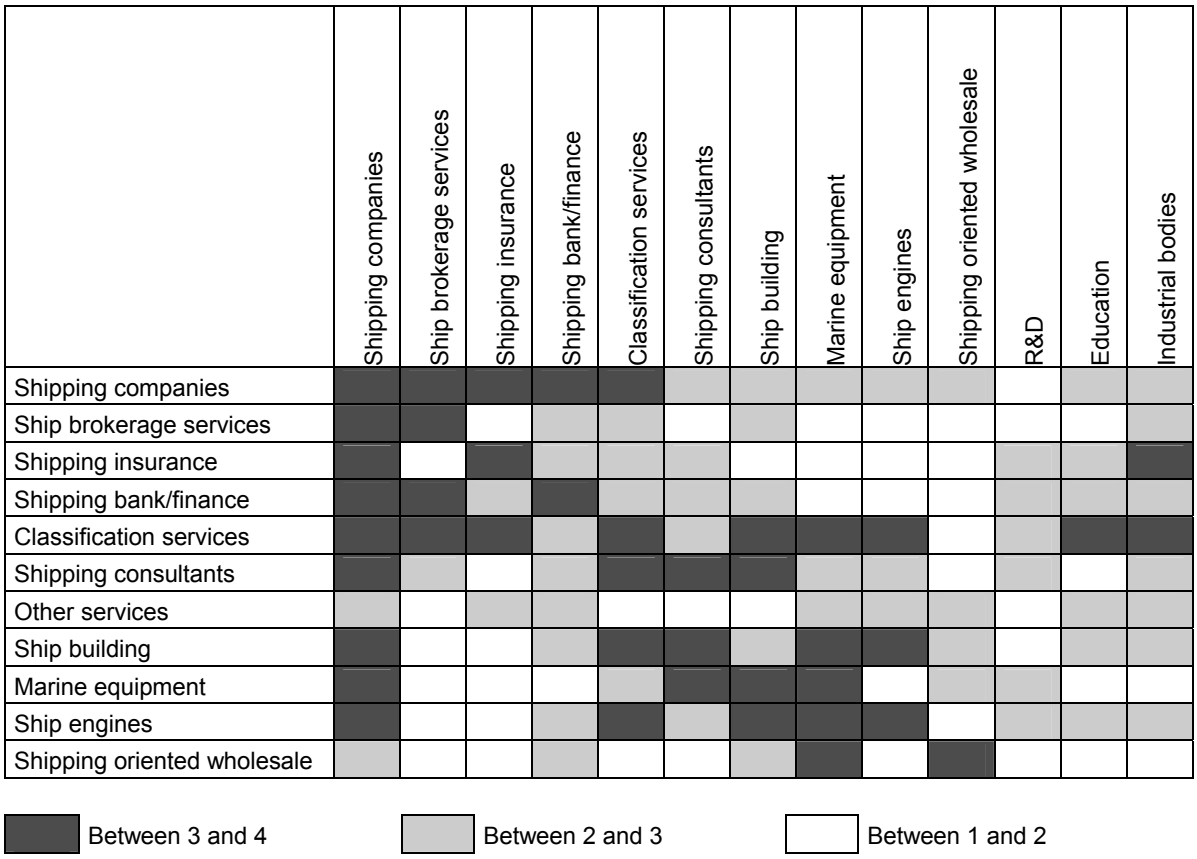

Figure 77: The strength of linkages in the maritime industry

The Global Maritime Benchmarking study [39] found that Norwegian maritime manufacturing and service firms have strong internal and mutual links compared to the other four national clusters [39]. Manufacturing is in this study defined as activities connected to shipbuilding, such as design, equipment production, hull production, repair etc. Services is connected to maritime transportation such as ship operation, port operation, ship brokers etc. The highest innovation pressure was found within the Norwegian manufacturing sector. The manufacturing companies have weak international links, and low co-operation compared to the other countries. The service sector seems to co-operate mostly nationally, and this sector has cluster linkages both in breadth and in depth. The service sector also seems to have good international links in general, but the co-operation is often not related to innovation.

One of the most important developments in the maritime industry in the recent years, is related to information and communication technology (ICT) and logistics. As mentioned before, a growing part of Norwegian shipping is in the high differentiation segments. Many companies have started to use ICT, but there are areas where there is great potential for developing competitive advantages. ICT, as a technology, will have an important impact on automation, surveillance, and simplification on the ships and on the ships operations. Also, the ICT business sector may challenge the power positions of the shipping companies in the management of logistic chains and network based organisations involved in shipping. Finally, ICT as an enabler may simplify, improve, and support business processes. This may make it possible to keep healthy

margins in a business with a strong pressure on costs, and it may be possible to improve the delivery of services [68].

In a review of Norwegian shipping research, it was concluded that it is necessary to use skills, special and core competences in different companies [46]. Increasing co-operation between companies in the maritime cluster, creates opportunities for developing sustainable competitive advantages. However, co-operation outside the traditional maritime cluster, is also necessary. For instance, the growth of demand in multimodal and intermodal transportation makes co-operation with companies in other sectors of transportation necessary.

The outcome of inter organisational co-operation has the potential to include a complex composition of competencies and technologies. In addition, intimate co-operation between independent corporations requires advanced relational skills. Co-operation may therefore give companies competitive advantages that are hard to imitate. ICT may, as pointed out, enable more efficient co-operation between different organisations. New ICT-solutions are also crucial for managing the complex logistics of multi- and intermodal transportations [46].

The following case exemplifies the challenges that many shipping companies face in relation to information and communication technology. The case also shows how integration of skills and competencies within several companies provide a basis for developing competitive advantages that are difficult to imitate.

Illustration 5: Andreas Ugland & Sons and United European Car Carriers

Andreas Ugland & Sons employed a higher number of engineers than most of the company's competitors. This made it possible to develop skills, competencies, and new technical solutions. New, technical solutions are important but do not necessarily create sustainable competitive advantages. However, Andreas Ugland & Sons also stimulated its employees to constantly develop new solutions, often in co-operation with customers and other companies. The result was skills, competencies and strategic assets within particular technologies, in entrepreneurship, and in co-operation with other companies, which played together and created a distinctive capability. Many of the innovations were sold soon after they were introduced into the market. The first specialised car carrier company, United European Car Carriers, established in the early seventies, is one example of what this capability gave birth to. United European Car Carriers now controls a fleet of 24 specialised car carriers. Its headquarters is located in Oslo, but most of the operational organisation is located in Grimstad on the southern tip of Norway. UECC has 12 subsidiaries throughout Europe.

The company has focused on car transportation, while cargo in the ro-ro segment has been a supplement. UECC has purposely created a very high standard in areas such as quality control, terminal services, and customer tailored products. As other shipping companies, UECC has met an increasing demand for door-to-door services. However, multimodal services create new challenges related to logistics, ICT, and inter organisational co-operation. UECC, and many other maritime companies, can choose to focus on the sea transport only. Such a strategy will put a strong pressure on reducing costs. In a high-cost country, such a strategy is difficult to apply. An alternative strategy is to increase the differentiation of the services. The development of door-to-door services provides one important source of differentiation. This will increase the necessity of co-operation with other types of transport companies. Also, control over the complex logistics will probably be important for building sustainable competitive advantages. If so, intimate co-operation with highly qualified maritime logistic consultants and ICT companies will be crucial. This increases the importance of being located in a solid maritime environment.

7.5. Qualities of the Norwegian maritime cluster

Competition, co-operation and innovation pressure

In the studies of the regional maritime clusters in Norway, referred to in *Figure 76*, the researchers asked a total of 700 leaders in the maritime industry about the degree of demanding customers, the competitive intensity, the innovation pressure, and co-operation. The results of these studies are summed up by Hervig and Jakobsen [32].

Proximity to demanding customers and competitive intensity is important, because it is assumed to create innovation pressure [84]. Several studies have shown that innovation is important for competitiveness and profit (see *Chapter 4*). The degree of demanding customers and competitive intensity are measured on a scale from 1 to 4 (low to high). *Figure 78* shows how the leaders in the maritime clusters view their environment with regard to these variables.

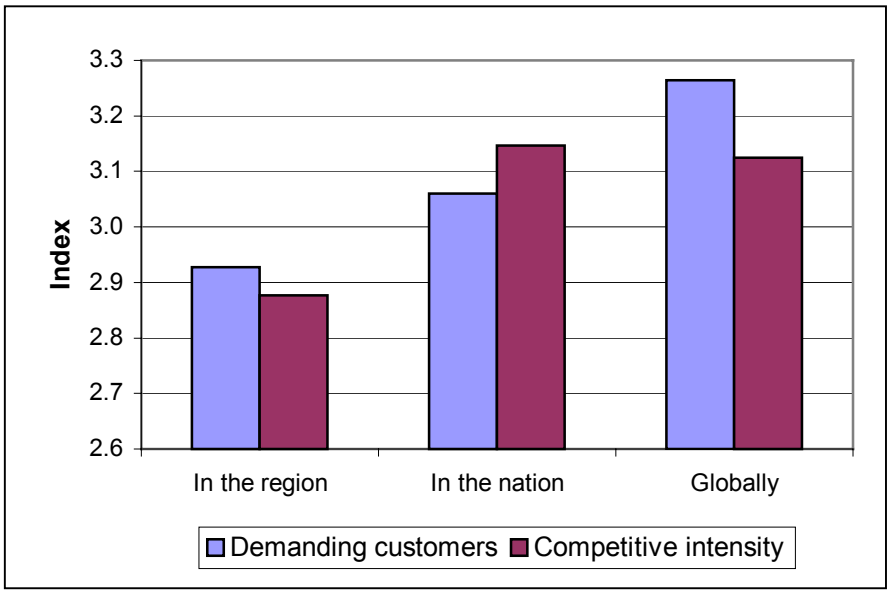

Figure 78: Demanding customers and competitive intensity [32]

The degree of demanding customers is viewed as lowest in the imminent environment (the region) of the company, and highest in the global market. The competitive intensity is also viewed as lowest in the region, but it is now viewed as highest in the nation. Although the degree of demanding customers and competitive intensity is viewed to be as high as 2.9 in the region and as high as 3.1 in the nation on the scale from 1 to 4, further stimulation of the regional and national cluster processes is probably important. This is supported by the fact that the growth in value creation is significantly higher in the regions with high degree of demanding customers and competitive intensity. Also, there is not a negative relationship between regional competition intensity in the maritime sector and regional innovation co-operation. Instead, the data indicate that co-operation and competition are positively related [32].

Production factors

Proximity to production factors, such as labour, capital, suppliers and infrastructure is assumed to be an important effect of clusters [84]. *Figure 79* provides an overview of how leaders within the maritime cluster evaluate the importance, quality, and access to labour, capital, suppliers, and infrastructure on a scale from 1 to 4 (from low to high).

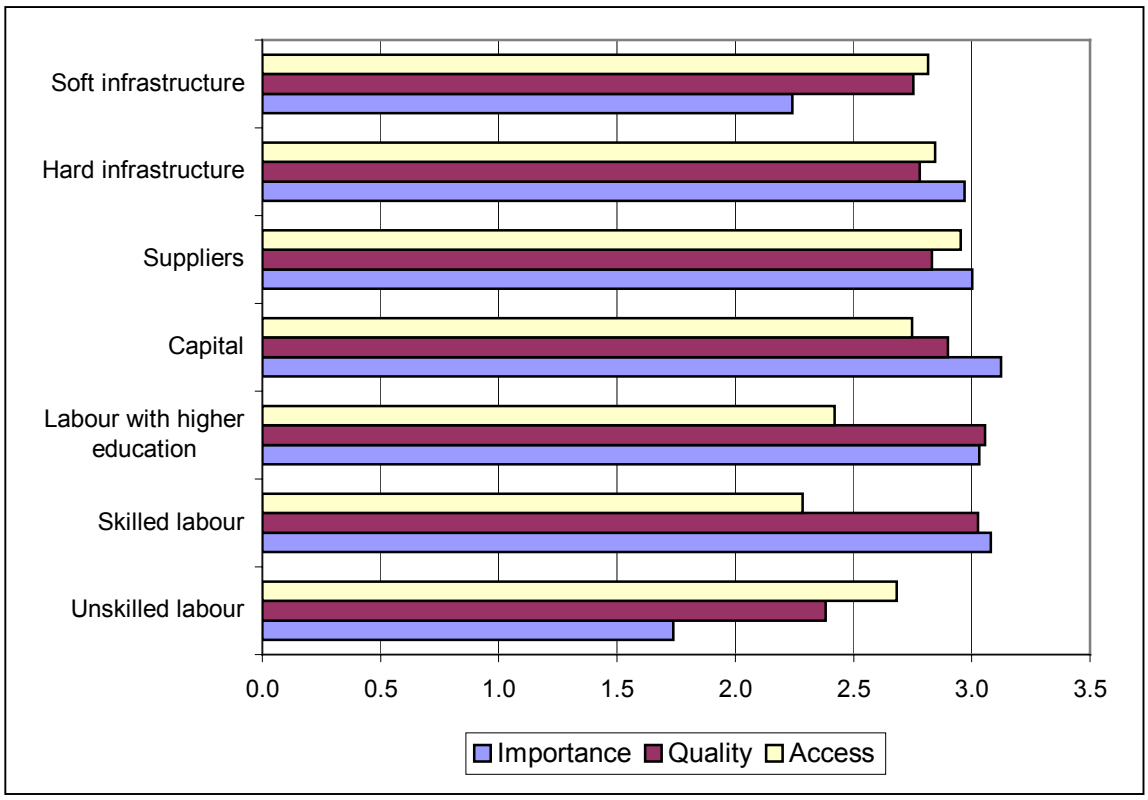

Figure 79: Selected production factors in the maritime cluster [32]

As *Figure 79* shows, access to skilled labour and labour with higher education is ranked as lower than the importance and quality of such labour. In such a situation it is worrying to observe that Norwegian maritime companies invest less in staff, have weak tools for career planning and have less support for higher education compared to other European maritime nations [39]. Also, access to capital is in *Figure 79* ranked a little lower, on average, than the importance of capital. Unskilled labour is not viewed as very important and the access to such labour is reasonably good. Access to soft infrastructure, such as cultural activities, restaurants, shopping centres is also good compared to the importance. With regard to suppliers and hard infrastructure such as roads, ports, airports the rank of importance, quality and access is relatively similar. As *Figure 79* shows, importance, quality and access is not ranked above 3.1 for any of the variables. This result may imply that there is room for improvement for all production factors.

There are also major differences between the importance of quality and access to production factors, between the maritime regions within Norway [32]. The general conclusion is that access to suppliers and capital, best match the importance and quality in the largest regions (Oslo/Akershus, Southern Rogaland, and Hordaland/Sogn

og Fjordane). For the rest of the production factors, the relation between size of the maritime region and access is weak.

Illustration 6: Bergesen D.Y. An international leader firm

Bergesen D.Y. ASA is an example of a leader firm. The company is today one of the largest shipping companies in the world, with more than 3500 employees. 250 employees are employed at the headquarter in Oslo. In 2002, the company had an operating revenue of US$ 583.8 million and a profit (after tax) of US$ 26.2 million. The company operates in four markets: gas, tanker, dry bulk and offshore. In March 2003 the company owned and/or operated a fleet of 105 vessels: 80 gas carriers, 12 crude oil tankers, 4 FPSOs/FSOs, and 9 dry bulk vessels.

The international competitive situation of the maritime sector is well exemplified by Bergesen. Their customers are located all over the world. The company was established in 1935 in Stavanger, where the founder Sigvald Bergesen D.Y. lived. In order to come closer to the major ship brokers and maritime banks, the company relocated to Oslo shortly after World War Two. One of the most important reasons for being located in Norway, is the strength of the maritime environment. Access to human resources has also been an important factor for the location. Caused by the increasing cost of labour in Norway, the number of Norwegian seamen onboard Bergesen's ships has decreased rapidly and the company has now recruitment offices in several countries.

Bergesen emphases that they work in segments where customer interaction and tailor-made solutions create value added. The company is the world's largest owner and operator of gas carriers, and the clear market leader in larger gas carriers. In the spring of 2003, a controlling part of the company was acquired by Hong Kong based World-Wide Shipping but Bergesen will still be managed from Norway. However, the future localisation of the management of the company will be an important indication of the value of Norway as a host country for large shipping companies.

Location attractiveness

Although Norway has one of the most complete maritime clusters, the maritime industry in Norway and in other countries do not seem to perceive Norway as a very good location for maritime businesses. This is at least the case when Norway is compared to Germany, UK, Denmark and the Netherlands [39]. The Netherlands seems to be regarded as the most attractive country to be located in for companies already located in the Netherlands and for foreigners. Over 80 percent of the companies inside the Netherlands views it as the best location for the company and about 19 percent of the non-Dutch companies would choose the country as their headquarter location. For Norway, which is placed on the bottom of the list, the same numbers are a little below 40 percent for domestic firms and approximately 3 percent for foreigners. It has to be underscored that this conclusion is drawn from a relatively weak statistical bases (a total of 483 respondents in five countries and a response rate of about 5 percent).

Cluster policies

The Norwegian government has not intervened heavily in the development of the maritime cluster (or other clusters). The overall policy seems to be that the governmental policies should be sector neutral. However, there are some exceptions to this policy. As mentioned, in the recognition of the importance of the maritime industry in Norway and the international competitive situation of the industry, the government phased out the traditional company tax and introduced a tonnage tax for

the shipping companies. The Norwegian authorities also support maritime research and education. However, in the referred study of European maritime nations, Norway has one of the lowest satisfactions of public policy. This is probably due to deterioration of the tonnage tax system, an unfavourable net-wage system, and a general impression of a passive government. The researchers of this study underscore the fact that the survey was conducted in a period with a very strong Norwegian currency.

7.6. Strengths and weaknesses of the maritime sector in Norway

Table 33 provides an overview of the strengths and weaknesses of the maritime cluster in Norway.

Strengths	Weaknesses
• A long maritime history that have created the cluster with a unique composition which is difficult to copy [96] • High growth rate in the maritime cluster [5][32] • Strong innovation pressure in the manufacturing sector [39] • A relative complete cluster including many maritime industries [96] • Several maritime world class services [10][96]) and international linkages [39] • Many global market connection which provide a considerable experience based knowledge [10][96] • Many competence connections which creates upgrading mechanisms in the cluster [96] • Strong relationships between ICT sector and the maritime industry [96] • Good commercial understanding and competence [10] • Maritime companies are often flexible and vigorous [10]	• A high cost disadvantage • Less desire for innovation among ship builders and shipping companies [96] • Moderate competition in the regional and national market [96] • Moderate innovation pressure [96] • Foreign seamen out-compete Norwegian seamen [10] • Shipping companies are moving abroad [10] • Too strong separation between shipping and the shipping industry [96] and between education/research and the maritime industry [96] • The technological competence in the shipping companies is reduced [10] • Recruitment of skilled and higher educated labour [32][96] • Less investment in employees, weak tools for career planning and less support for higher education compared to other European maritime nations [39] • Many shipping firms have moved abroad and other firms can easily do the same • Norway is not perceived to be a very good location for maritime firms compared to other European maritime nations [39]

Table 33: Profile of strengths and weaknesses of the maritime industry in Norway

7.7. Agenda for the future

In order to secure future growth in the maritime industry in Norway, it is necessary to utilise the strengths and increase the effort to overcome the weaknesses of the industry. The high-cost disadvantage in the Norwegian maritime cluster, creates a need for developing high differentiation value through innovation. There are several areas in which such an intention can be pursued. It probably calls for both policy measures, co-

operative agreements between businesses (maritime and non-maritime) and internal business development. This section provides some ideas on how the cluster can be developed further and how companies can increase the utilisation of the maritime cluster. Before going into this discussion, it is important to underscore that it is beneficial for companies to ensure that top management supports innovation and that the company creates a deliberate and unambiguous strategy for innovation [45]. It is also important to further develop the shipping network.

The Norwegians still have a strong fleet of low differentiated services, such as oil tankers. This may be related to the strong position in this market during the last 30 to 50 years. They are able to compete in these markets by combining smartly, low factor costs around the world. The strength in these markets may also be caused by a possibly stronger differentiation and specialisation within the traditional commodity segments in Norway, compared with other low/cost countries. There are no quantitative data available that support this argument. However, in the investigation of the competitiveness of the maritime cluster in five European countries, the Norwegian firms seem to be the least sophisticated [39].

Even though the Norwegians are strong in some commodity markets, there is now a higher growth rate in the high differentiation segments. The high-cost disadvantage makes it necessary to promote growth in such maritime sectors. It is, therefore, vital to focus on the development of the competence intensive part of the cluster. Relevant competence and knowledge will increase its importance, as tomorrow's most critical competitive factor.

It is not enough to stimulate the firm internal competence. In order to create competitiveness in the global market, the companies within the cluster must integrate special and core competencies in different companies. Such an effort has the potential to create sustainable competitiveness, because the process or service outcome hopefully will consist of a complex composition of competences and technology, and because it requires advanced relational skills. Also, the relationship between shipping and the shipping industry might strengthen the long-term competitiveness. For instance, there seems to be a potential for increasing the interaction between the producers of marine equipment and shipping companies. This may give the equipment industry better opportunities to experiment in the technology development phase and stimulate the innovation in shipping companies.

There are several areas of innovation opportunities. For instance, the growth of demand in intermodal and multimodal transportation, creates such opportunities. New ICT-solutions handling the complex logistics of intermodal and multimodal transportation, may provide differentiation opportunities. The relatively good relationships between ICT and shipping in Norway, creates a potential for developing systems that can handle the complex logistics involved in intermodal and multimodal transportation.

Also, the creation of intermodal and multimodal transportation, often requires extensive co-operation. Such co-operation is also, as pointed out, important in order to develop sustainable competitive advantages. It is central to increase better interplay of skills and competences between internal organisational units, between different shipping firms, between shipping and other transportation firms and between shipping and other sectors of industry. A vital part of such an effort is to increase co-operation within the maritime cluster. In order to increase such co-operation it is necessary to improve relational skills, e.g. by developing better communication routines, information sharing systems, connecting internal and external organisational units, and developing more trust among co-operating firms. Relational skills may help companies to better utilise the benefits of the maritime cluster.

Competence and access to qualified personnel is very important. It is of vital importance to [68]:

- Create qualified seamen (especially officers);
- Develop new ICT and logistic competence;
- Develop new leaders with better management education, in order to create better market adaptation and innovation;
- Keep the maritime knowledge in the shipping companies in a situation where access to personnel with nautical experience is decreasing.

It is not only Norway that faces an increasing competition from low-cost countries. This competition should be met by increasing the sophistication and differentiation of the maritime industry, such as discussed above. However, adjustments in the tax system and level of cost is important, at least in order to create a better level playing field in Europe. Finally, it has to be underscored that most of the maritime nations in Europe are facing the same challenges from low-cost countries. This may, as will be discussed later in this book, call for a more coordinated European maritime policy.

8. ENABLERS OF MARITIME CLUSTER DYNAMICS

8.1. Introduction

Both Norway and the Netherlands have a great maritime past and present. *But, do these countries also have a great maritime future?* This depends on a number of factors, such as the general economic development in the two countries, the ability of the entrepreneurs to adapt to the ever-changing competitive environments, and on the development of the maritime cluster in the two countries. However, it also depends on the development of the entire European maritime cluster.

Chapter 4 briefly discussed cluster theories, which were summarised in *Figure 51*. In *Chapter 5* the theoretical discussion continued and demonstrated the difficulty to benchmark the different clusters in Europe. These difficulties are related to the research method, in particular the large amount of data that has to be collected, the very different structures of the clusters and the lack of a level playing field. Based on this discussion, 9 indicators were formulated, which are deemed crucial for the benchmarking of clusters at a national and a European level.

The aim of the current chapter is to develop a set of cluster enablers that are geared to removing inefficiency and stimulate the further development of the maritime cluster in the Netherlands and Norway, as well as in Europe. Increasing the knowledge and learning capabilities of the cluster, and the international competitiveness, lay the foundation for a more holistic national and European public policy towards the clusters. *Figure 51* also reveals the importance of these variables for the upgrading mechanism within the cluster.

Nine groups of performance indicators have been defined that contain the enablers of maritime cluster dynamics. This chapter discusses the performance indicators in more detail, on the basis of which the cluster enablers will be defined. Finally, the performance indicators and cluster enablers will be put to the test with the case-studies of Norway and the Netherlands.

8.2. Cluster performance indicators

Structural indicators

The fundamentals of a cluster are determined by the type and number of its maritime sectors. The broader the cluster in terms of sectors, the greater its potential synergy and strength. *Figure 80* illustrates the non-linear relationship between the cluster *completeness* and the cluster strength to adapt to change and generate synergies.

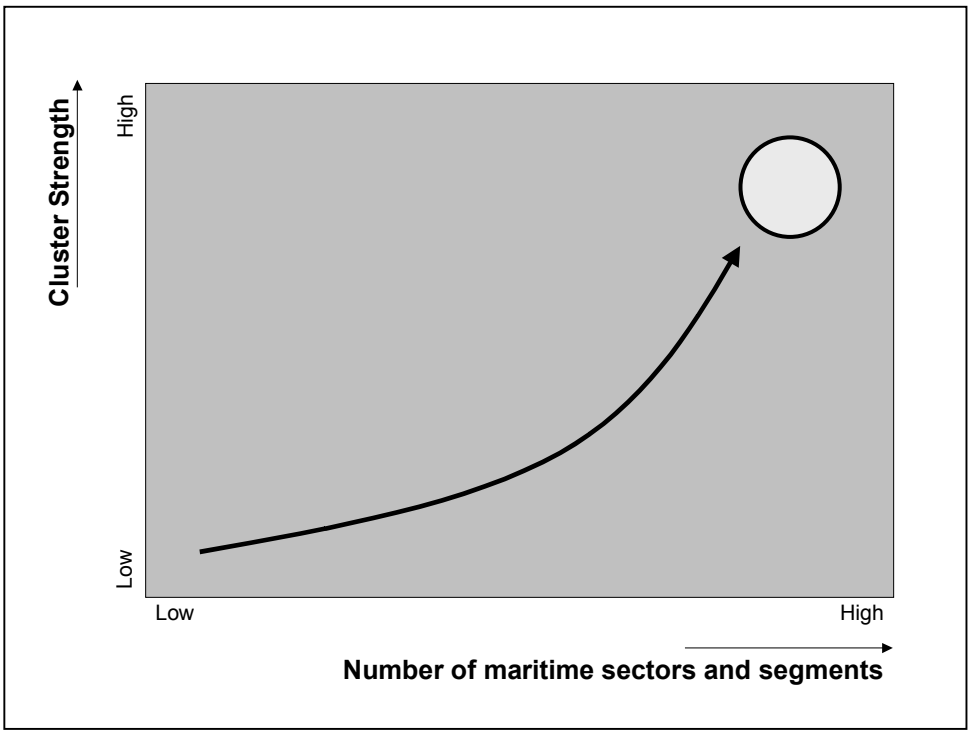

Figure 80: Cluster strength and the number of sectors

Not all sectors have the same importance within a cluster. Sectors within the cluster that order new capital equipment are the cluster demand drivers, for example, the shipping, offshore, inland shipping, dredging, fishing, naval sectors. These sectors have a stronger impact on cluster dynamics than the supply sectors like shipbuilding, marine equipment, yachting, maritime services and ports.

Figure 81 illustrates the relationship between demand pull and supply push sectors and the overall cluster strength. For example, a strong shipping sector, or the extreme demands on naval vessels, are very important drivers of the long-term cluster dynamics. The cluster is strongest when all the demand pull and supply push sectors are present (1); the next best position is (2), which means a strong presence of demand pull sectors, while the more vulnerable position is a heavy presence of supply push sectors (3) which depend on foreign demand pull sectors for their sales.

Another important aspect is the geographical concentration or dispersion of the various sectors, and the companies within a cluster (*Chapter 4*). This is clearly demonstrated by the difference between Norway and the Netherlands. Norway consists of seven regional clusters, some of them more than 1000 kilometres apart, while the entire Dutch cluster is concentrated within a circle with a radius of 150 kilometres. The closer the distance the higher the chances of interaction between the sectors and the companies (*Chapter 6* and *Chapter 7*). This is illustrated in *Figure 82*.

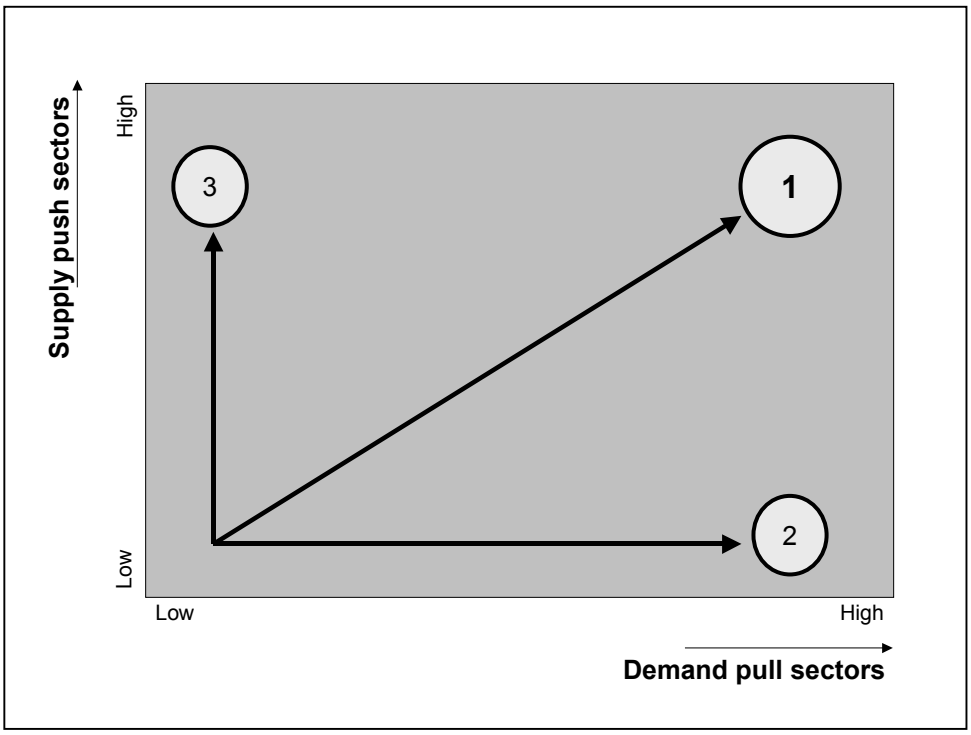

Figure 81: Demand pull and supply push sectors and cluster strength

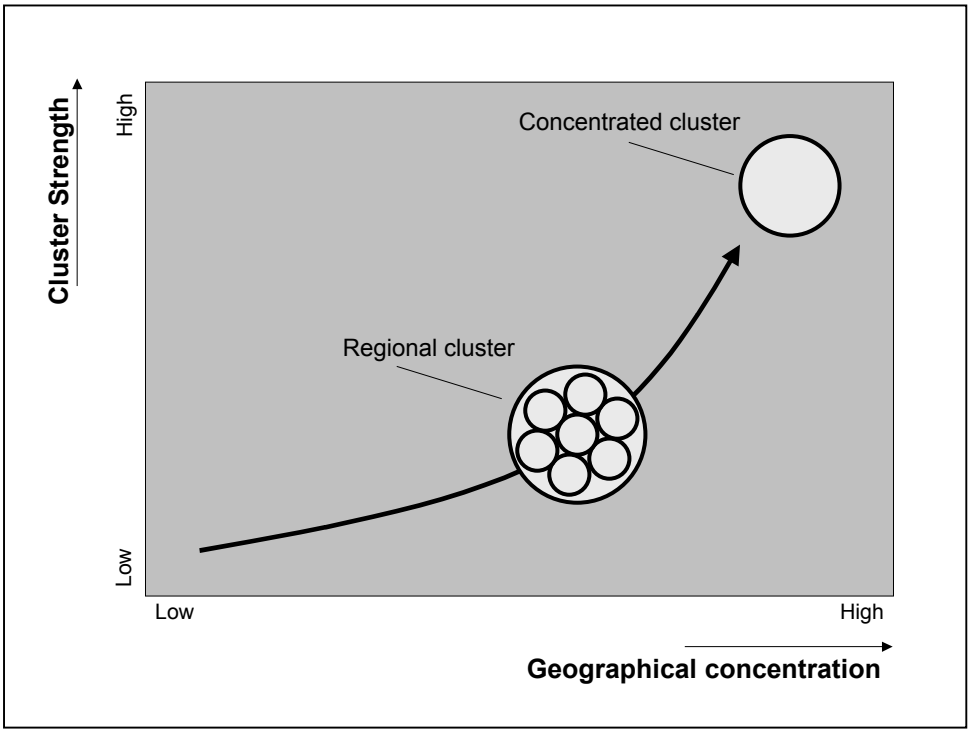

Figure 82: Cluster strength and the level of geographical concentration

Economic indicators

The standard economic performance indicators are used, such as the value creation of the cluster, expressed in direct and indirect value added, share in GNP, employment, backflow to the government, (foreign direct) investment, export quote and balance of payments contribution, growth over time. Important performance indicators are the

demand-supply relationship between the (maritime) sectors as these express the inter-relatedness, and the multiplier of each sector in relation to the other sectors and the economy as a whole. *The higher, the stronger the cluster* counts for all these indicators.

	Economic performance indicators
1	Direct value added
2	Indirect value added
3	Share in GNP
4	Growth rate
5	Multiplier (within cluster and national)
6	Employment
7	Export and balance of payments
8	Domestic investment
9	Foreign direct investment

Table 34: Economic performance indicators

Internationalisation

For small countries, the ability to export is usually a clear indication and empirical evidence that sectors and companies are able to compete in the global market place and are thus by definition competitive. A good measure is the export quote, which is the percentage of the total production that is exported. The higher the export quote, the stronger the sector and the cluster. Maintaining this export position, in the absence of subsidies, can only be achieved if the companies remain innovative and market leaders. This requires that the strong export position is gradually transformed into a high level of internationalisation. These companies have a high level of foreign direct investment and production, and sell their products and services on a global basis. In the long term, a strong export position is difficult to maintain in the face of competition from, for example, the Asian countries. The level of internationalisation is thus an important indicator for the long-term dynamics of the cluster. Not only outward investments are relevant, but also incoming investments from foreign companies into the cluster.

Figure 83 illustrates this situation. Ideally the strongest cluster has a high export quote and a high level of internationalisation. Most clusters follow the route (1) from strong exports towards a strong international position. Policies should be directed towards strengthening the second route (2). This means that in an early stage, entrepreneurs should be stimulated to become international (trans-national or better, multi-national) companies.

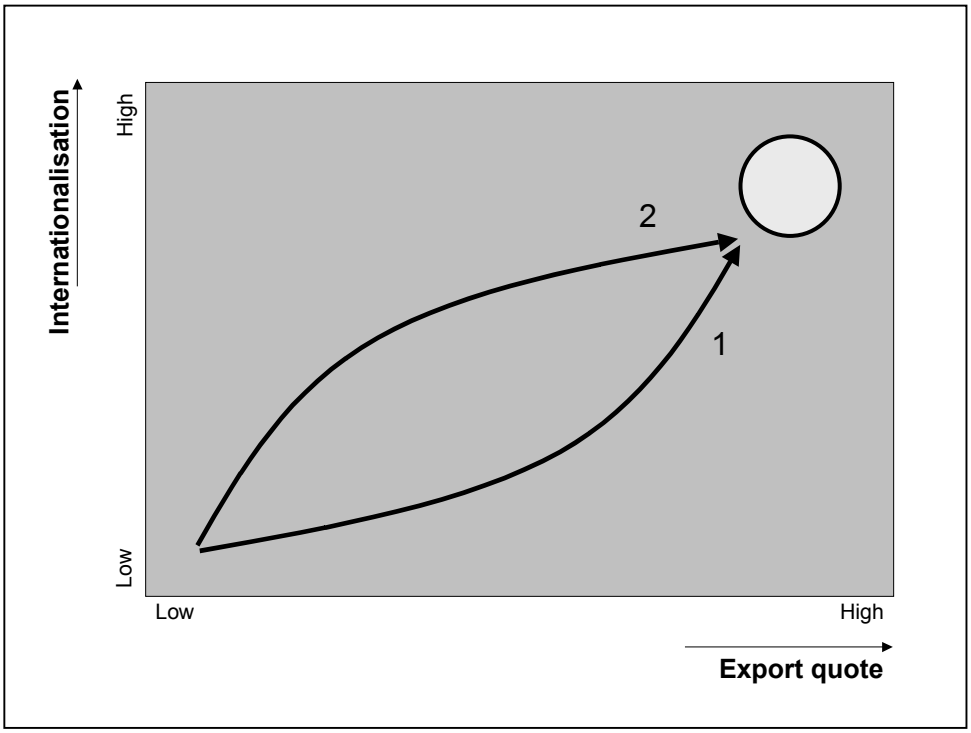

Figure 83: Export quote, level of internationalisation and cluster strength

Critical mass and leader firms

The larger the maritime sectors and the country's maritime cluster as a whole, in terms of production value and value added, the more chance there is that companies become market leaders, have the drive and funds to invest in innovation, and are able to upgrade the cluster as a whole. The companies reach critical mass to sustain growth, and the companies that achieve this status are called the leader firms. The concept of leader firms has been discussed in *Chapter 4*. Critical mass has a number of important aspects, which will be briefly discussed as these determine to a large extent the dynamics within clusters.

Critical mass is a size at which a business or market undergoes a fundamental change in regard to operations. An example of such a change, is a company's achievement of increasing returns to scale. *Economy of scale* is the reduction in cost per unit resulting from increased production, realised through operational efficiencies. Another example of critical mass is *economy of scope*, an economic theory stating that the average total cost decreases as a result of increasing the number of different goods produced. Yet another example of critical mass is *economy of time*; being first to market brings huge advantages in an information economy.

There are various ways for firms to gain critical mass, or to realise economies of scale, for example through integration. This occurs when two firms join together to form one new company. Integration can be voluntarily (a *merger*) or forced (a *takeover*). There are a number of reasons why companies wish to merge. Integration increases the size of the firm, and larger firms can achieve more internal economies of sale. Large domestic firms are then more able to compete against large foreign multinationals. Integration allows firms to increase the range of products they manufacture

(diversification). Diversified firms no longer have *all their eggs in one basket*. Another important driver behind the increase in size of firms. The larger the size of the companies in a certain international sector, the more important it is for firms to increase their own size in order to create comparable economies of scale. The perfect example in the maritime sector is container shipping. Since the creation of this new segmentation in the mid-1960s, the top-tier of container lines control the vast majority of the capacity. Size is crucial in this market.

The concept of leader firms is intimately linked to this development. Maritime leader firms are able to initiate innovation processes on a large scale, thereby integrating many smaller suppliers and stimulating them to innovate and export as well. The presence, the number and market share of maritime leader firms in a cluster, is a clear indication of the ability of a maritime cluster to export, innovate and upgrade itself. *Figure 84* shows the relationship between critical mass of the (maritime) sectors, the presence of (maritime) leader firms in a cluster and cluster strength. There is of course a causal relationship between the first two variables: strong sectors generate strong leading companies and vice versa. The cluster strength is enhanced by the presence of strong sectors and strong leader firms.

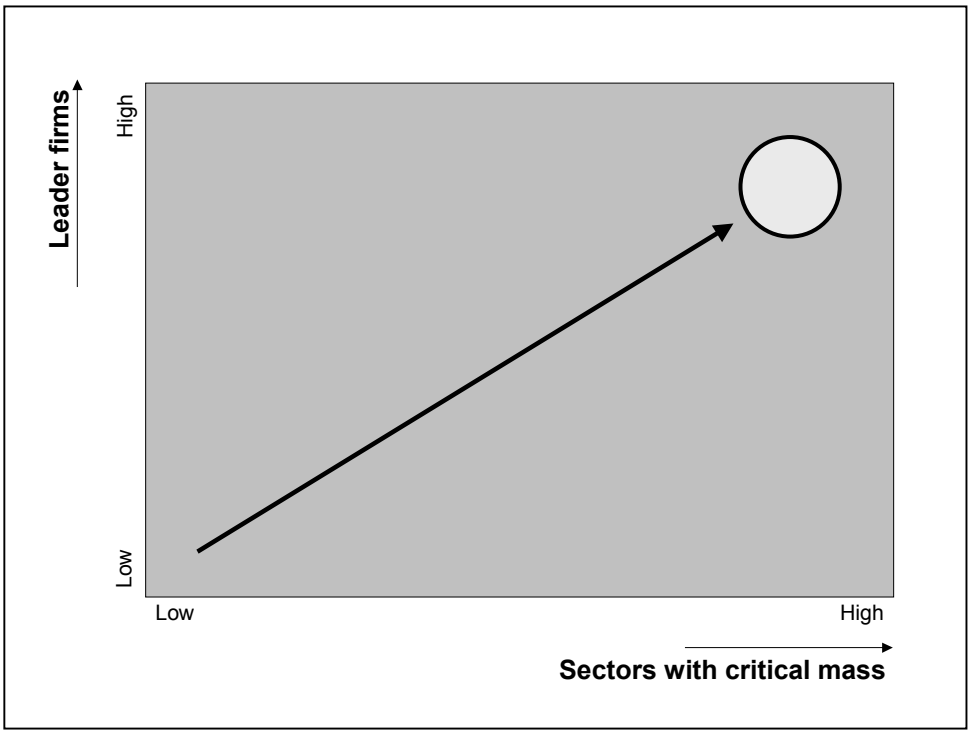

Figure 84: Critical mass, leader firms and cluster strength

Level playing field

Unfortunately, in many maritime markets there exists no level playing field. These markets are distorted by regulations that prohibit access, protect industries by subsidies, or more in general, induce companies to seek fiscally sunnier climates. Countries, or better governments, that are able to create a level playing-field for their maritime clusters have a better chance to have leader firms, innovation, export, value added, critical mass and upgrading mechanisms. A good example of a policy that

created a level playing field is the new shipping policy introduced in the Netherlands in 1996. This policy has successfully been copied by other countries in Europe.

An example of an European initiative to improve market conditions and upgrade a sector is the scrap-and-build policy of inland vessels which was introduced in 1990 until 1998, and it was prolonged to 2003. Under this programme more than 4,000 obsolete vessels were scrapped and replaced by a modern fleet, with little intervention from the national and European authorities, but a large commitment from the shipowners

Illustration 7: EU Maritime Policy: scrap-and-build Programme in inland shipping [22]

Inland shipping plays an important role in Europe. This maritime sector is based on the extensive network of rivers and canals, situated in six countries of the EU: Austria, Belgium, Germany, France, Netherlands and Switzerland.

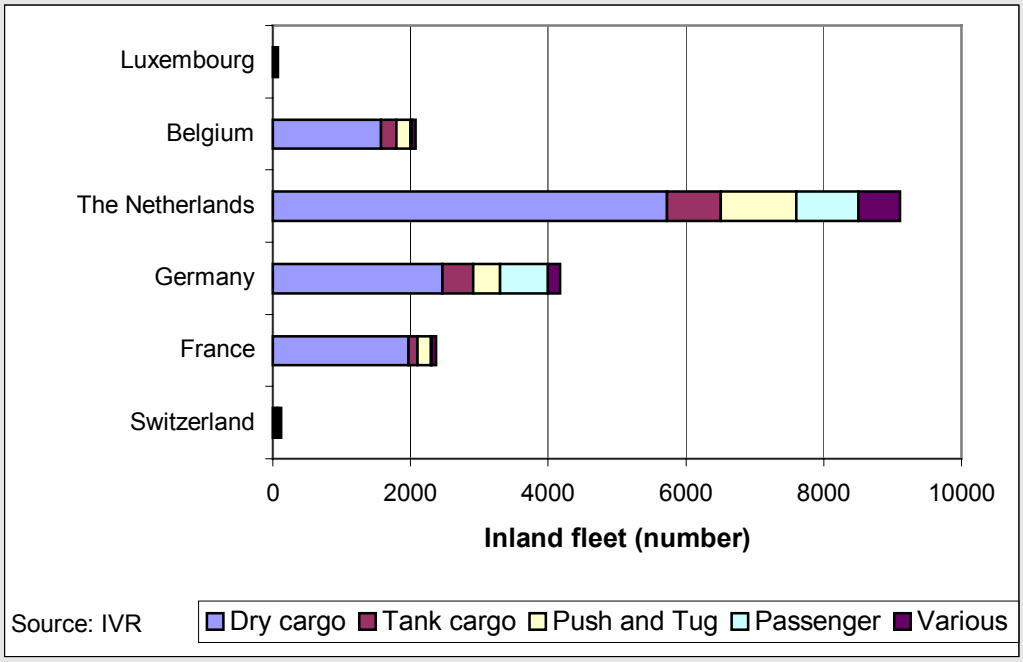

Figure 85: Number of inland ships in Europe [37]

The inland shipping fleet is made up from thousands of ships and many different ship types. Because of the sheltered and fresh water rivers, the wear and tear (corrosion, fatigue) on inland vessels is a fraction of that of seagoing ships. The lifetime of inland vessels is consequently at least double the lifetime of seagoing vessels. Many inland vessels and their owners are in difficult economic times willing to sail for rates that only pay for the variable costs, thus driving the freight rates down as well as the return on investment.

The over-capacity and old fleet of inefficient inland vessels led in the second half of the 1980s to a major European crisis in this sector. In 1989 the EU stepped in with a daring scrap-and-build programme for the shipowners in the six river states, which became effective January 1, 1990. Shipowners could offer their ships for scrapping during the first four month of this year, for which they received a generous price out of a EU scrapping fund. This fund was funded by three parties: the European Commission, the inland shipping sector and the six member states concerned. A shipowner who wished to build a new ship had to scrap a number of smaller old ships (either his own ships, or ships bought in the open market) amounting to the same capacity as the new building.

The scheme was very successful and the EC and member states decided to prolong it several times. During the period that it was in force (1990-1998) an impressive number of 4,109 ships was scrapped with an aggregate tonnage of 2.9 million. The contributions to the scrap funds by the three parties involved, amounted to €338 million, of which the inland shipping sector contributed €157 million, the EU €25 million and the selected member states €156 million.

The scrap fund triggered a major new-building boom which resulted in an upgrading of the fleet, increase in productivity and many innovations, such as new ship types (e.g. containers), engine types, handling equipment, increase in economy of scale, etc., as well as in a reduction of (over)capacity. Consequently the freight rates in the various trades improved with more than 20-100 percent over the 9-year period.

This example shows that the EU can play an important role in the restructuring of maritime sectors. This positive experience can also be extended to some parts of the short sea shipping sector, which faces similar over-capacity and restructuring problems as the inland shipping sector did in the 1980s.

The distortion in the global shipbuilding market has been discussed in *Chapter 5*. The lack of a real level playing field in and outside Europe, poses a real threat to the survival of this sector. If the EU and the national governments are not able or willing to safeguard a level playing field, than the sector is likely to perish and disappear. This will have important negative impacts on the entire cluster, because of the high level of inter-relations between the sectors. Maintaining a level playing field is thus probably one of the most important conditions for the dynamics and growth of a cluster and its long-term strength. *Figure 86* shows this relationship schematically.

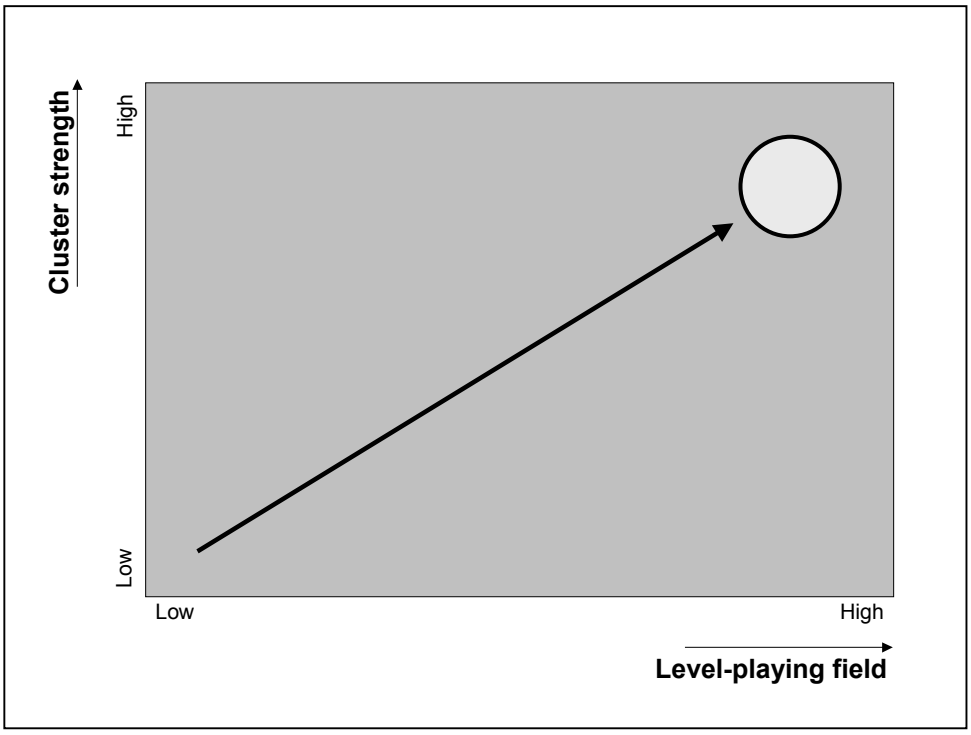

Figure 86: Level playing field and cluster strength

Innovation

The presence of a strong maritime services sector (R&D) and marine equipment sector are good indicators for the innovative strength of the cluster and the pace of diffusion

of innovation within the cluster. The marine equipment sector is an important intermediary to adapt innovations from one sector to another and to translate national and foreign demand into new products and processes. There exists an important relationship between innovation and exports. Exports stimulate innovation, and innovation drives exports. The more innovative the individual sectors are, the stronger the cluster becomes as a whole. Leader firms often drive the innovation cycles within sectors. Therefore they should become a prime mover of government induced innovation and research & development policies.

Figure 87 shows two paths that sectors and cluster may follow. The traditional path in global sectors is the route (1) via exports, which ultimately create a demand pull on innovation and R&D. The other route (2) is supply push driven, as innovative products and services are developed and exported. Innovation and R&D determine in that case the cluster strength. This is the route that many governments try to achieve, but unfortunately it requires major investments in (public) R&D infrastructure and education.

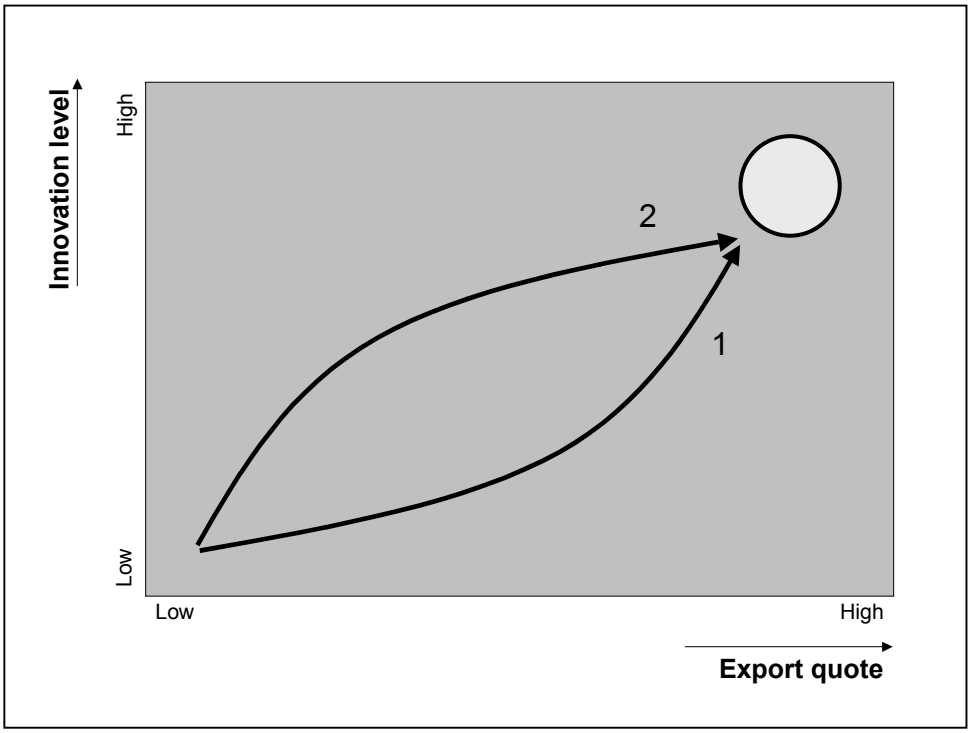

Figure 87: Exports, innovation and cluster strength

Institutional framework and business networks

The quantity and quality of the companies, their trade organisations, the quality of the cluster networks, the level of interaction with policymakers and politicians, all determine the strength of the cluster. The stronger these multi-faceted networks, the greater the chance of positive cluster dynamics and upgrading. A well-informed government will do its best to support a level playing field, or stimulate innovation and R&D expenditures, promote exports and will help attract foreign direct investment.

The conditions and relationships between the business networks and the institutional framework is extensively described in Porter's model in *Chapter 4*. A strong commitment from the government to an industrial policy that supports the sectors at a cluster level, is a prime condition for the long-term cluster strength.

Labour market and education

A cluster requires a well-educated workforce, a broad set of expertise and a high level of education. Many maritime sectors require the same basic education or training. A large and diversified cluster offers, therefore, many employment opportunities and increases the attractiveness to chose for a maritime career, which in turn will attract the best talent. A broad and specialised educational infrastructure will help to maintain the innovativeness of the individual sectors. A well-functioning labour market is of paramount importance to the cluster strength.

Image and communication

A positive image and a continuous two-way communication effort between the companies, the trade organisations, the cluster network, the policymakers at local, provincial and national levels, as well as the general public is of the essence if the cluster wishes to attract to best people and maintain a high-level of dynamics. The status of the maritime profession varies widely in different countries. In Norway, maritime entrepreneurs have high status, which is reinforced by the fact that among the richest men in the country are maritime entrepreneurs.

8.3. Cluster enablers

A performance indicator of the cluster is not necessarily an enabler of excellent performance. The objective of this paragraph is to translate the performance indicators into concrete enablers that can be used as policy instruments by the stakeholders in the cluster to improve the performance collectively.

On a company level the definition and measurement of performance criteria is usually part of a Strength-Weakness-Opportunities-Threats analysis. The SWOT analysis is useful to identify possible company strategies, such as build on strengths, resolve weaknesses, exploit opportunities, and avoid threats. Strengths and weaknesses are essentially *internal* to the organisation and relate to matters concerning the company's resources, programs and organisation in key areas. These include sales, management, operations, products, finances, R&D, costs and systems. The *external* threats and opportunities confronting a company, can exist or develop in the company's own industry where structural changes may occur. They can also exist in the marketplace, which may alter due to economic or social factors, while competition may create new threats or opportunities using new technologies resulting in fundamental changes in products, processes, etc. The SWOT analysis provides ultimately the company's enablers which fit the aforementioned business strategy options.

Cluster enablers are to a large extent identical to the company's enablers. It is the responsibility of the company's themselves to make their SWOT analysis, define the performance indicators and gaps, and devise strategies to close these gaps based on a

set of enablers. *So the question is, which enablers are the sole domain of the company's management and which enablers are the collective responsibility of the entrepreneurs and the national government or even the European Union*? Seven cluster enablers, which are deemed crucial for the upgrading of the maritime cluster, have been defined. These will be discussed below.

Enabler 1: Define cluster, establish its significance and promote visibility

There are a number of obvious general conditions that have to be met if a cluster policy and cluster enablers are to be developed. If a country has, for example, a business climate in which entrepreneurial behaviour is not appreciated and stimulated, then it will be hard to involve a government in a process of consultation that may lead to an industrial policy. Or, if the value added by a cluster is very small, then it is difficult to draw government attention.

A major hurdle in getting focus on the importance of clusters in the economy, is often the simple fact that a cluster does not exist statistically in most economies, as individual sectors of a cluster are often part of different statistical entities. The picture gets even more complicated when companies produce for maritime and non-maritime markets.

The first step should, therefore, be defining the sectors within a cluster and establish the key economic performance indicators and communicate these data. This is an important *enabler at the conceptual level* in the minds of the politicians, government, labour force, educational institutions, the general public, and last but not least the entrepreneurs themselves. Without the right mindset, based on an accurate perception of reality, cluster policymaking is not possible.

This should also happen at the European level, as the EU R&D policy demonstrates. The maritime cluster is in terms of value added larger than many industrial sectors in Europe, such as aeronautics. Most R&D in the maritime sectors is, however, part of a one-off project and therefore not reported separately under the R&D heading by the companies. In the minds of the policymakers, the maritime industries are therefore not part of the high-tech industry and therefore do not deserve a substantial R&D budget within the R&D Framework Programmes. Although, the current EU LeaderSHIP 2015 initiative[10] with the involvement of seven EU-Commissioners may mean a turning point in this perception. The active involvement of leader firms in the initiative underscores the important role of these firms for the cluster dynamics.

Enabler 2: Define an industrial policy

Once the (maritime) cluster has been made visible, it is important to understand its internal dynamics and the many relations between the sectors and sub-sectors of the cluster. The government should acknowledge these clusters as important building blocks of the economy. Sectors are always subject to changes in their competitive environment, and it is up to the government to create the right conditions for these

[10] http://www.cesa-shipbuilding.org

sectors to adapt continuously. This, without distorting the level playing field of course. Some countries have well-defined industrial policies, like France in aerospace, aeronautics, nuclear energy, high-speed trains, etc. Based on these long-term views on industrial development, long-term policies are devised on which a cluster of industries, sectors and companies may base its own policies.. Porter has demonstrated the importance of such a shared belief among all the stakeholders in a cluster[11]. The existence of an overall industrial policy, formulated by the government, is an important enabler for any cluster (see *Chapter 4*, which discussed the various policy measures'. In absence of such a vision, entrepreneurs are left to themselves and will be less effective in adapting to change, which is, as we know, the only constant in the global economy.

Enabler 3: Strengthen demand pull sectors

Maritime sectors can be categorised into two groups: demand pull and supply push sectors. The demand pull sectors use the capital equipment and services of the other sectors. Demand pull sectors, like shipping, can order capital equipment within the domestic cluster or outside. Supply push sectors, like shipbuilding, in Europe are more and more exposed to foreign competition from South Korea, Japan and China. In the longer term, also the marine equipment and maritime services sectors will experience this fierce competition. In the long-term, the supply push sectors are more vulnerable to foreign competition than the demand pull sectors. These sectors will buy their capital equipment and services from the lowest cost supplier, wherever located. Strong and viable maritime clusters depend, therefore, on strong and internationally oriented demand pull sectors, such as shipping, offshore, fishing, naval, dredging and inland shipping. In particular the shipping sector offers opportunities for growth as the market is huge and the opportunities are many.

Cluster policy has been defined as an important enabler, but within a maritime cluster policy, demand pull sectors are the key-enablers of the cluster and should, therefore, be the focal point of government policies. The Norwegian and Dutch governments have implicitly understood this important driving function witnessing their shipping policies.

Enabler 4:Monitor and maintain a level playing field

Companies and whole sectors are confronted with unfair international competition. The WTO procedure from the European Commission against the unfair shipbuilding practices of South Korea is just an example. Denying market access, as is the case for many foreign maritime sectors in the United States because of the protective Jones Act, is clear evidence that it is not enough to be excellent as a company, if there does not exist a level playing field. Assuring *equal opportunity* for the maritime sectors in Europe, is an important enabler for a sector and the cluster as a whole. Sometimes the level playing field can be created by the national administrations, as was for example the case with the new Dutch shipping policy of 1996. Sometimes, the hurdles are such that the EU has to step in as is currently the case in the shipbuilding sector.

[11] http://www.compete.org

Continuously monitoring competition is an important aspect of any cluster policy. This should be done in close co-operation with the trade organisations and its members. Cluster growth is only enabled and assured if companies are not faced with unfair competition.

Enabler 5: Promote exports and internationalisation

Some countries have sizeable maritime home markets, unlike Norway and the Netherlands, which have to grow through exports and internationalisation. Reinforcing the level of exports and the number of companies that actively export is an important enabler of cluster growth and dynamics. Up to a certain level, exports can be done from the home country, beyond that level, companies have to internationalise their activities and start local production and services in export markets. This is often the case because of import levies, as for example the 40 percent import duty for equipment in China. Exports and internationalisation of companies, sectors and the cluster as a whole are basic enablers of maintaining a competitive cluster and creating cluster dynamics.

Enabler 6: Strengthen innovation, R&D and leader firms

Companies can only maintain their export position in the long-term, when they constantly upgrade their products, services and production processes. This requires an advanced research and development infrastructure and policies that stimulate entrepreneurs to innovate, exchange information and take risks together. The leader firms in the cluster are able to set demanding standards, trigger innovation and even organise a number of companies (from the supply sectors) to address the innovation challenges. Innovation is an important enabler of cluster viability. Leader firms are the anchor companies within a cluster and are important for the upgrading processes of the companies in a cluster. Monitoring and enabling leader firms, and in particular their role of enabling smaller suppliers to innovate, are essential elements to keep a vital cluster.

Enabler 7: Education and labour market

A high quality and complete maritime educational infrastructure, in combination with a transparent and large maritime labour market form together the seventh and last cluster enabler. Without well-educated individuals and sufficient career prospects within the sectors of the cluster, the future is not assured as an inflow of more and more highly-skilled people is a necessary condition for the modern operations, innovation, management, etc. Maintaining and strengthening the educational infrastructure is an important enabler, in particular for the nautical professions. Attracting the brightest people requires a positive image of the cluster, as well as a good two-way communication between the sectors and the general public.

8.4. Viability of the maritime clusters of Norway and the Netherlands

Norway and the Netherlands are two very different countries in terms of geography, population and economy. These countries have also many things in common. In the

past this was, the participation in the early cluster network of the Hansa cities, and in the present, strong maritime clusters, which are of European and global prominence. In this paragraph these two maritime clusters will be compared against each other, and in particular on the level of the cluster enablers which have been discussed in *section 8.3*.

Enabler 1: Define cluster, establish its significance and promote visibility

Norway was the first country in the world to define a maritime cluster, set up a cluster organisation (Maritime Forum) and initiate detailed studies of the various sectors in the early 1990s. It has facilitated the development of a conceptual model in Norway with politicians, government agencies, the maritime sectors and the general public of the economic significance of this cluster for the prosperity of the country as a whole. This is logical as the maritime sectors make up a proportionally large part of the economy, whether this is shipping, fishing or the offshore sector.

This awareness of the presence of a unique and sizeable maritime cluster in the Netherlands grew much later with the establishment of the Dutch Maritime Network organisation in 1997. This was inspired by the Norwegian example and triggered by the successful new Dutch shipping policy which was introduced in 1996. Contrary to the Maritime Forum, the Dutch Maritime Network was empowered by the government and industry with sufficient financial means over a long period of time. It had to initiate a large number of fundamental studies and to define the cluster and its sectors, as well as to establish and update its economic significance and inter-relations, and initiate actions to promote and reinforce the cluster. The detailed mechanisms within the cluster and the elements important for its upgrading and competitiveness are now well understood.

Norway and the Netherlands have both invested in the creation of a maritime cluster identity and its visibility and this has been an important enabler in addressing many common policy issues among the maritime sectors and to a certain extent, the government.

Enabler 2: Define an industrial policy

In spite of the important contribution of the shipping sector to the Norwegian economy, the government has not maintained a consistent policy, illustrating the 23 successive changes in its national shipping policy over the last decade. A change in government often means a change in policy, which is detrimental to the business climate. So, in spite of the detailed understanding of the economic importance of shipping for the economy, a consistent industrial policy does not exist. The value creation from shipping within Norway is, thus, not assured because of the lack of an overall shared view on the conditions (for example fiscal policy) under which the maritime sectors should operate. This is also the case with the very important offshore sector, which is even more dependent upon a long-term industrial policy, given the long-term nature of its investments.

The situation in the Netherlands is also confusing. In the past the government interfered in industries that were in great difficulty, such as shipbuilding, however,

with preciously little success. After a parliamentary inquiry after the allocation of these public funds, the government decided to abandon any sector-specific industrial policy and adopt a generic economic policy, making no distinction amongst industries. So computer chips industries are theoretically treated the same way as potato chips industries. Sometimes sectors or industries need extra support in order to restructure or to capitalise on unique growth opportunities. The daring new shipping policy which was introduced in 1996 was not the result of an industrial policy, but was initiated by the Ministry of Transport in close co-operation with the shipowners, almost against all odds. The existence of a clear and well-defined industrial policy is an important enabler for cluster development. The lack of or the erroneous changes in industrial policy make it very difficult to create a favourable climate for entrepreneurs and investments.

Enabler 3: Strengthen demand pull sectors

The maritime cluster of the Netherlands is made up of eleven sectors (see *Chapter 6*). Although each country uses a different set of definitions, it is clear that some sectors in the Netherlands do not exist in Norway (for example, inland shipping and dredging) or are of lesser importance (naval construction). Norway has a much larger shipping, offshore and fishing sector and is strong in certain maritime services domains, such as classification.

The Netherlands has six demand pull sectors: shipping, offshore, inland shipping, dredging, navy, and fishing. Norway has three demand pull sectors: shipping, offshore and fishing. These three Norwegian sectors have a much bigger critical mass than the Dutch sectors, which compensates for the lack of the other three demand pull sectors. The challenges for Norway and the Netherlands are identical: how to strengthen the demand pull sectors, as these form the economic drivers of the clusters and its upgrading mechanisms. The expression that *some (sectors) are more equal than others* also applies to the maritime sectors. The demand pull sectors are the basic cluster enablers and should therefore be handled with extra care. The supply push sectors like shipbuilding and marine equipment are of course also important to the dynamics of the cluster, but the demand pull sectors in the cluster can survive without them, but not the other way around.

Enabler 4: Monitor and maintain a level playing field

Even excellent companies cannot survive in the marketplace, if there does not exist a level playing field. The unfair shipbuilding subsidy war in Europe and the Far East requires a firm commitment from the EU, otherwise the shipbuilding sector may disappear and parts of the marine equipment and maritime services sectors with it.

Apart from removing subsidies, access to markets is an important element of a level playing field. Dutch and Belgian dredging companies would expand their business overnight if the USA was to abolish the Jones Act or Japan would open its borders. An example closer to home, is the access for foreign suppliers to offshore markets on the Continental Shelf and in the Exclusive Economic Zones. In hardly any market exists a perfect level playing field. Imperfections are rather the rule than the exception, which

does not mean that a government should not try to safeguard a level playing field for its industry. In particular in the enlarged Europe, this is of growing importance.

Level playing field is therefore an important enabler for the maritime cluster and its sectors, because of the international nature of maritime industries and the importance of these sectors to newly industrialised nations. Governments, should as part of their industrial policy, take actions to assure that the rules of the game are respected by all, either through national regulations, European directives, or WTO procedures.

Enabler 5: Promote exports and internationalisation

The shipping sector in the Netherlands has an export quote of over 90 percent, which contributes to the overall export quote of the entire cluster of over 60 percent. Companies that export, have to be internationally oriented, and diversify their activities around the world, which is important as the global economy unlashes fierce new competition in traditional strong sectors. The best protection against these new entrants should not be defensive, but should rather be offensive, exploiting *the attacker's advantage* as Richard Foster [24] has termed this strategy.

The Norwegian marine equipment sector has been very successful in its export and internationalisation strategy, riding the wave of Norwegian orders for ships in the Far East, whereby the owners specify Norwegian quality equipment. This, also, demonstrates the extreme importance of demand pull sectors in the cluster. The Dutch marine equipment sector has been much less privileged with building orders from Dutch owners abroad.

Government policy should be geared to stimulation of the exports and internationalisation of the maritime sectors as these initiatives create value, make the companies more competitive and upgrade the cluster as a whole. Exports and internationalisation are thus important cluster enablers.

Enabler 6: Strengthen innovation, R&D and Leader Firms

Markets, products and processes change rapidly and the companies and sectors can only maintain their competitive positions if they innovate. Innovation should be embedded in a solid research and development environment, and enabled by a high educational level of the work force and funds from the government for fundamental research. Maintaining a solid level of innovation and R&D is thus of paramount importance for the value creation of clusters, both in Norway and the Netherlands. Regular government support for maritime R&D expenditures is limited in the Netherlands. The problem is compounded by the fact that most companies belong to the group of SMEs, small and medium size enterprises, with little infrastructure and funds to spend on innovation. Therefore, the maritime leader firms are of great importance in the cluster as they are able to organise and orchestrate entire chains of suppliers. A good example is the development of the innovative suction hopper dredger, Volvox Terranova [58] or the salvage of the Kursk [75]. Another interesting example of leader firm behaviour is the Royal Netherlands Navy [30]. The government may consider, therefore, the creation of a platform on which it can discuss

cluster policies with this select group of maritime leader firms. When the leader firms, which are by nature already very international (sometimes already multi-national) companies, should decide to leave the country and the cluster, the innovative strength of the cluster will diminish. This is currently happening in other domains of the Dutch economy, where large parts of production and R&D are transferred to the Far East and Eastern Europe, where factor costs are structurally lower and markets grow faster.

Innovation, R&D and leader firms form the spark plugs in the engine of the entire cluster. Without them, the entire machine grinds to a halt. Therefore, innovation and leader firms are important enablers.

Illustration 8: Innovative trailing suction-hopper dredger Volvox Terranova [58]

One characteristic of leader firms is that they set high performance standards which requires a whole chain of companies to co-ordinate their innovation efforts. Such an example is the design and construction of the innovative trailing suction-hopper dredger Volvox Terranova (*Figure 88*) by the dredging company Van Oord ACZ in close co-operation with IHC Holland, the renowned builder of dredgers. A trailing suction-hopper dredger is like a giant vacuum cleaner; the suction pipe rests on the seabed at depths of up to 100 m, and sucks up the combination of sand and water. The more concentrated the mixture, the better the performance.

The basic innovation network is shown in *Figure 89*. The other companies in the network are the Maritime Research Institute Netherlands (Marin) which helped to develop new hull forms and innovative ways to place the engines and propulsion system in the aft ship, Rexroth Hydraudyne (Bosch Gmbh) produced the hydraulic systems and Bakker Sliedrecht the electrical installation and the generating (pump) systems, apart from the main engine (Wärtsilä). There were many more marine equipment suppliers involved, but these were part of the innovation networks of the main suppliers.

Figure 88: Volvox Terranova

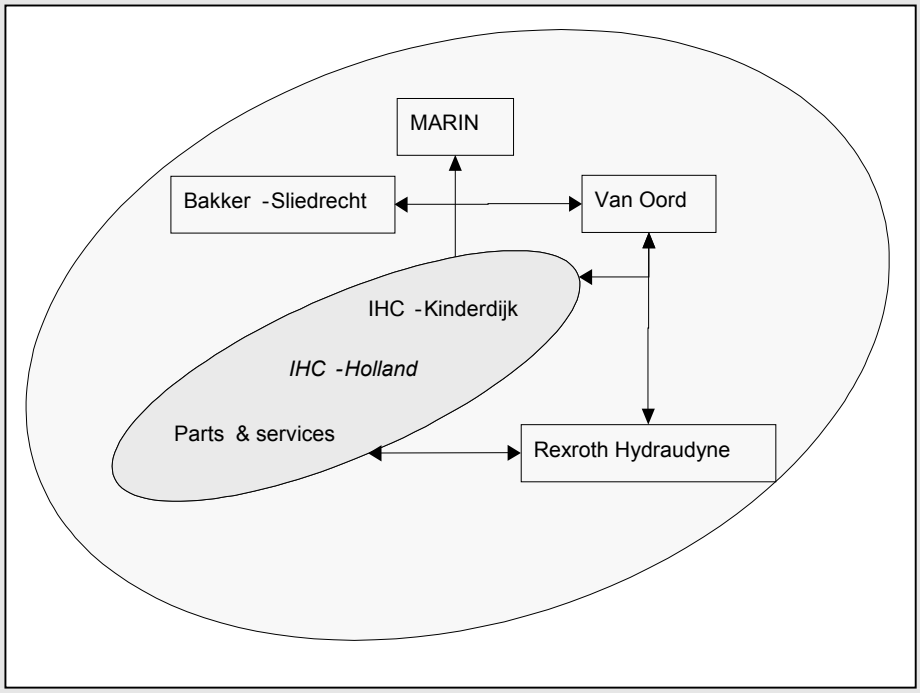

Figure 89: Innovation network

The innovation effort was driven by the objectives of Van Oord ACZ to increase the efficiency of the three basic tasks of a hopper dredger: suction (loading), transport and unloading. The suction operation could be improved by placing the giant pump (6 MW) not in the ship, but halfway in the pipe 50 metres below the waterline. This increased the capacity to a level where almost solid sand could be sucked up and pumped; the loading time of 30,000 tonnes of sand could therefore be reduced to less than one hour. A quick turnaround time was achieved by reducing the water resistance through an innovative hull, in particular the bow (with a bulb, not used before in dredgers), and placing part of the propulsion unit in gondolas outside the ship, thus increasing the payload capacity. These revolutionary hull forms for the dredging industry were extensively tested by Marin. (*Figure 90*)

Figure 90: Innovative hull form

Also the general arrangement on deck was completely overhauled as *Figure* 91 illustrates. On the right a conventional design, and on the left the new design. The new design requires less maintenance as it much simpler.

Figure 91: Deck arrangements

Only leader firms have the market position, the incentives, the financial means and the power to organise a whole chain of suppliers.

Enabler 7: Education and labour market

A well-functioning labour market and a specialised educational system is an important enabler for the renewal processes within the cluster. Clusters become rapidly international and this is reflected in the composition of the work force in terms of nationalities. Many well-known Dutch and Norwegian leader firms have already a minority of national employees. This process of internationalisation is accelerated by the enlargement of the EU with 10 member states in May 2004, but also through transfer of many lower administrative jobs to countries like India. An important enabler of this labour internationalisation process is the electronic data infrastructure and low cost communication technology. The transaction costs and speed of ICT have come down to a level that it makes less difference for companies where they are located, as long as the local labour force is well-educated and cheap. This is one reason why many lower level jobs are disappearing in the Netherlands and in Norway, also in the maritime cluster. Without adequate actions from the government in concertation with the relevant sectors, unemployment will again become an important issue on the political agenda.

The reduction of Norwegian and Dutch students at the nautical colleges is another serious problem for the long-term viability of the cluster. The mobility of nautical officers within the cluster is important, for example in ports for the provision of pilots, or as surveyors of ships. Maintaining a minimal level of nautical and maritime (engineering) educated students is an important enabler of the cluster.

Summary

The seven cluster enablers are summarised in the *Table 35*.

	Maritime cluster enablers
1	Define cluster, establish its significance and promote visibility
2	Define an industrial policy
3	Strengthen demand pull sectors
4	Monitor and maintain a level playing field
5	Promote exports and internationalisation
6	Strengthen innovation, R&D and leader firms
7	Strengthen Education and labour market

Table 35: Maritime cluster enablers

9. TOWARDS A EUROPEAN MARITIME CLUSTER POLICY

9.1. European economic policy

Since its inception, the European Union is expanding its role and influence in economic policymaking. The website[12] of the European Commission, illustrates this clearly. The four policy areas identified by the Commission are: economy and society, international affairs, institutional affairs, and finance. Each with several sub-headings, as *Table 36* illustrates.

Economy and Society	International Affairs
• Agriculture • Audiovisual • Biotechnology • Civil Society • Competition • Consumers • Culture • Customs Union • Economic and monetary union • Education and Training • Employment and Social affairs • Energy • Enterprise • Environment • Fisheries • Food Safety • Freedom, security and justice • Information Society • Internal Market • Public Health • Regional policy • Research, Development Technology and Innovation • Space • Sport • Taxation • Trans-European networks • Transport • Youth	• The European Union in the World • Development • Enlargement • External assistance • External trade • Foreign policies • Humanitarian aid
	Institutional affairs
	• Governance • The Future of Europe debate
	Finance
	• Budget • Fight against fraud • Grants • Public Procurement

Table 36: Major policy areas of the European Commission

A number of these policy themes influence, directly or indirectly, the maritime sectors and the European maritime cluster as a whole. For example, the *economy and society* theme, contains policy domains like: transport, trans-European networks, taxation, research-development-technology-innovation, internal market, fisheries, enterprise, energy, education and training, customs union and competition. The *international affairs* theme contains policy domains like: external trade and enlargement.

[12] http://www.europa.eu.int/comm/index_en.htm

What may be the implications of these themes for the future and viability of the European maritime clusters? Some of these issues will be briefly explored in this section.

Economy and society

Transport

The Directorate-General for Energy and Transport is responsible for the development and implementation of European policies in the transport sector. The European Commission (EC) published in 1992 a White Paper on Transport with the main objective to open up the transport market in Europe. This objective has been largely achieved since then, and it has generally resulted in lower transportation costs. This in turn has stimulated demand for transport and in particular that of road transport. The EC published in 2001 a second *White Paper on Transport*, which addresses the main issue: the increasing demand for mobility, resulting in an increasing congestion, poor quality of services, damage to the environment and compromising safety. At the same time, the EC acknowledges the economic importance of the transport sector for the European economy. The total turnover of the sector is estimated at €1000 billion, and it generates 10 percent of the EU's GDP, while employing 10 million people.

The current problems are expected to increase in importance, due to the correlation between economic growth and mobility. The overall transport demand of goods is expected to increase by 2010, with almost 40 percent and that of passengers with 24 percent. It is clear, road transport will even increase by 50 percent if nothing is done to counter this development. The main objective of the White Paper is, therefore, to devise policy measures that integrate transport into sustainable development, in other words, to break the link between economic growth and transport growth (see *Chapter 1*). The possible solutions, which the EC advances are: charging the real costs to road transport users, revitalising the other transport modes, and targeted investment in infrastructure. These solutions have been translated into 60 measures that should result in a significant break in the link between economic and transport growth, without restricting mobility, by making more efficient use of the existing means of transport. The measures are not restricted to the European level, but involve measures at the national and regional level, in the context of other EU policies. This means that national governments have a certain freedom to take policy measures that are not necessarily part of the *official* EU transport policy, or are part of other policy domains, such as budgetary and fiscal policy. This is an important statement, as it provides the room for national creativity and experimentation. For example, a country may adopt a new shipping policy that may violate to a certain extent other (i.e. fiscal) EU policies. The White Paper proposes in more detail four operational objectives:

- Shift the balance between modes of transport;
- Eliminate bottlenecks;
- Place users at the heart of transport policy;
- Manage the globalisation of transport.

Deep sea shipping plays a vital role in the European economy, as 70 percent of the external trade is seaborne trade. The EU is very ambivalent in its relation with the shipping sector. Although European owners still own the largest fleet in the world, the number of ships registered under the national registries has dwindled, like the number of European seafarers (minus 40% since 1980).

Short sea shipping carries more than 40 percent of the intra-community goods and its growth is impressive. New policies are aimed at enhancing this growth further, as it may alleviate the road transport congestion. The use of the inland waterways, which carry 9 percent of the European goods, can also be expanded. The interfaces between sea and land, the ports, could be made more flexible and less costly. The intermodality is also promoted, in which the shipping, ports, inland shipping, road and rail transport sectors co-operate at an unprecedented level. The enlargement of the EU with 10 countries makes these issues even more pressing. The Trans-European Networks policy forms a cornerstone in this process of European integration.

Trans-European Networks

The idea of Trans-European Networks (TENs in EU jargon) emerged by the end of the 1980s in conjunction with the proposed Single Market**.** It made little sense to talk about one big market, with freedom of movement for goods, persons and services, unless the various regions and national networks making up that market, were properly linked by modern and efficient infrastructure. The construction of Trans-European Networks is also a central element for economic growth and the creation of employment. The Treaty establishing the European Union, provides a sound legal basis for the TENs. Under the terms of Chapter XV of the Treaty, the European Union must aim to promote the development of Trans-European Networks as a key element for the creation of the Internal Market and the reinforcement of Economic and Social Cohesion**.** This development includes the interconnection and interoperability of national networks, as well as access to such networks. In accordance with these objectives, the Community is developing *guidelines* covering the objectives, priorities, identification of projects of common interest and broad lines of measures for the three sectors concerned (Transports, Energy and Telecommunications). The European Parliament and the Council approved these guidelines, after consultation of the Economic and Social Committee and the Committee of the Regions. A large number of projects of common interest have benefited from financial support of the Community budget through the TEN-budget line, as well as the Structural Funds and Cohesion Fund. The European Investment Bank (EIB) has also greatly contributed to the financing of these projects through loans.

Taxation

The European Commission presented, on 23 May 2001, a comprehensive strategy for the EU's future taxation policy. The Commission is of the meaning that tax policy should support broader EU policy objectives, such as making the EU the most competitive economy in the world by 2010. Increased tax co-ordination would help Member States to meet these objectives. However, while a large measure of harmonisation is necessary in the VAT and excises fields, in other tax fields tax co-ordination does not imply tax harmonisation. The Commission intends to focus more

attention on the tax problems facing individuals and businesses operating within the Internal Market.

Research, development, technology and innovation

Conducting European research policies and implementing European research programmes is, in first instance, a legal and political obligation resulting from the Amsterdam Treaty. The Treaty does in fact, include a whole chapter on research and technological development (RTD), so as to underline that RTD is an essential element in the functioning of industrialised countries, such as EU Member States. The competitiveness of companies and the employment they can provide, depend, to a great extent, on RTD; while RTD is also essential for the support of other policies, such as consumer or environmental protection. But Europe must also play an active role in RTD, because of a number of developments inherent to the RTD sector itself. High-level research is increasingly complex, interdisciplinary and costly. Therefore, it requests a constantly increasing *critical mass*. Hardly any research team, research laboratory or company can reasonably claim to be able to respond to these challenges. Even entire Member States find it increasingly difficult to be active and play a leading role in the many important areas of scientific and technological advance.

Organising co-operation at different levels, co-ordinating national or European policies, networking teams and increasing the mobility of individuals and ideas is therefore a requirement resulting from the development of modern research in a global environment. Without determined actions at European level the present fragmentation of Europe's efforts cannot be overcome. Taking up this challenge, the European Commission, Member States and the European Parliament, the scientific community and the industry are now committed to work jointly towards the creation of a *European Research Area* (ERA). A series of initiatives, aimed at making the ERA a reality, have already been launched, including the new *framework programme for Research and Technological Development 2002-2006*. The new (6^{th}) framework programme is an important tool in supporting the ERA, alongside national efforts and other European co-operative research activities. The framework programme will support co-operative research, promote mobility and co-ordination and invest into mobilising research in support of other EU policies.

The European Research Area has 22 domains. Transport and maritime transport research can be found under two of these domains: surface transport, and other transport research. *Surface transport* research includes an action on *Land transport and marine technologies*. The growing demand for transport in Europe, requires development and deployment of sustainable new transport methods and concepts. This action targets development of the technological infrastructure required for innovation, while maintaining and consolidating the competitive position of European land transport (road and rail) and marine industries as well as intermodal activities. For maritime technologies, priority is placed on more efficient, safe and environmentally-friendly ships and innovative marine technologies particularly for unmanned operations. The marine technologies action defines three critical technologies for waterborne transport:

- *Efficient, safe and environmentally friendly ships and vessels*, looking at improved concepts and European approaches for concurrent and multi-site design, engineering or production;
- *Maximising interoperability and vessel performance*, looking at port infrastructures, reducing operating costs, improving manoeuvrability of ships in restricted waters and ports and efficient cargo handling and transhipment;
- *Innovative technologies for monitoring, exploration and sustainable exploitation of the sea*, addressing unmanned surveying, in-situ monitoring and industrial operation.

The technology platforms selected for maritime transport are:

- *Competitive shipbuilding.* Research is helping to demonstrate streamlined and seamless vessel development processes and systems, and support advanced production systems which improve customer response, product quality and manufacturing process flexibility and control
- *Safe, efficient and environmentally friendly vessels and platforms.* Efforts are concentrating on**:**
    - Fast vessels for passengers, cars and cargo;
    - Deep sea ships for passengers and unit cargo;
    - Deep sea floating structures for production storage and off-loading of gas;
    - Unmanned, autonomous and remotely operated survey vehicles;
    - New concepts for short sea operations and polar shipping.
- *Efficient interoperability and transhipment.* Research is focusing on integrating advanced concepts for unitised cargo and for ship types operating in coastal, restricted and limited waters. The strategic aim is to demonstrate concepts for multimodal cargo units and reinforcing intermodal links to ease improve and facilitate cargo flows between inland waterways and the sea.

Other transport research includes research actions in related fields, which affect, for example, the offshore industry and fall under the energy programme, such as the *Energy, Environment and Sustainable Development* Programme.

Internal market

The free movement of people and goods is an important element of the EU Treaty. Implementation of these objectives required many structural and legal changes, a process, which is still in progress. The free movement of goods is a current topic with a potentially great impact on European transport. The ‘Customs Union and free movement of goods’ is aimed at the elimination of the bureaucratic customs procedures. They form a bottleneck for a modal shift towards short sea shipping, which is an EU transport policy priority. This example illustrates the importance of a holistic approach to policymaking, also for the maritime sectors.

Fisheries

In March 2001, The European Commission adopted a Green Paper on the future of the Common Fisheries Policy (CFP). Its objective was to stimulate a debate and to give everyone a chance to have their say, before the Commission adopted its proposals for the review of the CFP. In the Green Paper, the Commission set out a number of options for the future of the CFP and asked all those concerned for their views. The EC has defined six policy areas: conservation and responsible fishing, restructuring the fishing sector, aquaculture, common organisation of the market, enforcement of the law in the fishing sector, fishing beyond Community waters. These six policy areas will greatly affect the future of the European fishing sector and this will have an important impact on the value added, employment, investment and the shipbuilding and marine equipment sectors as well.

Enterprise

The Lisbon European Council of 23 and 24 March 2000 set a new strategic objective for the European Union for the coming decade: *To become the most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth with more and better jobs and greater social cohesion*. To this end, in April 2000 the Commission adopted a Communication and a proposal for a Multi-annual Programme indicating how its enterprise policy could meet the challenges of globalisation and the new knowledge-driven economy. The Communication on the Challenges for enterprise policy in the knowledge-driven economy sets a strategy for Enterprise DG. The principal objective is to achieve an *Enterprise Europe*, a sustainable economy based on knowledge and innovation, by 2005. The Communication accompanied the proposal for a specific multi-annual programme of activities. In December 2000 the Council approved this proposal and thus adopted the *Multi-annual Programme for Enterprise and Entrepreneurship, and in particular for Small and Medium-sized Enterprises (SMEs) 2001-2005*. The programme focuses on new economy challenges to SMEs and it is used as a means of progressing towards the objectives set by the European Charter for Small Enterprises.

Energy

The offshore industry plays a vital role in the provision of energy, in particular oil and gas, for the European Union. Apart from this, the offshore installation sector may also contribute to the success of the implementation of the renewable energy strategy of the EU. The European Commission's *White Paper for a Community Strategy* sets out a strategy to double the share of renewable energies in gross domestic energy consumption in the European Union by 2010 (from the present 6% to 12%) including a timetable of actions to achieve this objective in the form of an Action Plan. The main features of the Action Plan include internal market measures in the regulatory and fiscal spheres; reinforcement of those Community policies which have a bearing on increased penetration by renewable energies; proposals for strengthening co-operation between Member States; and support measures to facilitate investment and enhance dissemination and information in the renewables field. In practical terms, the EC wants to increase the wind power capacity with 10,000 MW of wind turbine generators, which will be installed for a large part at sea. A taxation policy for marginal offshore

fields and wind power installations may have a great impact on the success of these policy objectives, and on the future of the offshore industry as a whole.

International affairs

External trade

The growth of world trade and the growth of European imports and exports is a key policy objective of the European Union. The European Commission plays an important role in the negotiations with the World Trade Organisation (WTO) and its precursors. There are also many bilateral agreements, also in the framework of development policies of third world countries. Free access to markets is very important for most of the international maritime sectors of Europe. In many (developed) countries there are still serious obstacles that hamper the growth of the European maritime sectors. Even within Europe, the maritime markets are far from perfect, although serious progress has been made during the last decades. International trade is the driver for many maritime sectors, such as shipping and shipbuilding, but also ports, dredging and inland shipping. Growth of the maritime cluster can be enhanced by a strong position on WTO. Therefore, it may also be necessary to have a strong position in international organisations, like the International Maritime Organisation (IMO). It is, therefore, necessary to show the real size of the European shipping sector and to carry its weight in the rule and regulatory institutions like IMO. It is questionable that independent registers without any national fleet and domestic shipowners, should have any statutory impact on the rulemaking within IMO.

EU enlargement

After successfully growing from 6 to 15 members, the European Union is now preparing for its biggest enlargement ever, in terms of scope and diversity. 13 countries applied to become new members: 10 countries in central and eastern Europe (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, Slovenia) and Malta, Cyprus and Turkey. On October 9, 2002, the Commission recommended to close negotiations with Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia. The objective is that the first group of ten new members joins the EU in time for the elections to the European Parliament scheduled for June 2004. The enlargement will increase the intra-Community transport flows and this may prove to be an opportunity for the (short sea) shipping sector. At the same time, the low-cost transport labour force in these countries may upset the current competitive position of the companies in the rest of the EU.

European maritime cluster policy rationale

EC policymaking with respect to the maritime sectors and the cluster as a whole, is very fragmented. In some ways this is normal, as all sectors and companies should in principal be treated the same way, with the historical exception of the agricultural sector. There are, however, reasons that warrant the formulation of a European Maritime Cluster Policy. Some of the reasons will be summarised below.

Strategic

Europe is surrounded by seas. The protection and safeguarding of maritime trade can only be done if Europe controls a substantial share of the world fleet and world shipping. Without this leverage, Europe could become vulnerable. Shipping depends on many other maritime sectors like shipbuilding, marine equipment and ports. The maintaining of critical mass, competitiveness and innovation is a condition for the long-term viability of European shipping. A maritime cluster policy may acknowledge this important reality[13].

Economic

The European maritime cluster represents an important share in the GNP of the EU, which is reflected in its value added, employment and exports (Chapter 3). The strength of the cluster depends on the strength of the individual sectors. The past has shown that European countries that lose their critical mass, or entire sectors (shipbuilding) tend to lose a lot more maritime activities, and in some instances its entire infrastructure. A cluster policy may prevent this.

Geographical

The sea is an important and cheap highway within Europe, with a tremendous unused capacity. Besides, it contains many resources on a sea level (fisheries) and a sub-sea level (oil & gas). It facilitates the connection of many outlying regions via cheap and fast means of transport. The sea may alleviate the congestion on land. The sea separates countries but it is at the same time the medium to create cohesion. On top of that, the sea helps to integrate the many new countries in Europe, this in spite of the great distances. A cluster policy would formulate and support policies that reduce the geographical constraints within the European economy. There are enough reasons to strive for a generic *European maritime cluster policy*. *What should this policy look like?* In order to substantiate this need further, more specific European policies for the various maritime sectors will be discussed, on the basis of which a holistic EU cluster policy can be founded.

9.2. Towards a European maritime cluster policy

The rather fragmented way in which the individual sectors of the maritime cluster are part of the larger EU economic policy agenda, reflects the problems that the maritime cluster encounter in most of the countries of Europe. There does not exist a clear identity of the cluster and consequently there is no such thing as a holistic approach to policymaking. The framework with the seven enablers of maritime cluster development on a country level as proposed in *Chapter 8*, will now be translated into an overall European set of enablers. This might form in the future the basis for the Commission's economic policy integration, thus eliminating the fragmented way the maritime cluster is handled today. The seven cluster enablers are summarised in *Table 37*.

[13] It is strange that the naval forces are not part of this strategic policy picture in the EU.

	Maritime cluster enablers
1	Define cluster, establish its significance and promote visibility
2	Define an industrial policy
3	Strengthen demand pull sectors
4	Monitor and maintain a level playing field
5	Promote exports and internationalisation
6	Strengthen innovation, R&D and leader firms
7	Strengthen education and labour market

Table 37: Maritime cluster enablers

Define cluster, establish its significance and promote visibility

The European Commission has made a major effort to define the European maritime cluster, as discussed in *Chapter 3*. The attempt to define the European cluster in great detail, demonstrated its economic significance, and may be an example for maritime sectors and countries to copy this initiative. It has resulted in cluster studies in Germany, the UK, Finland and Sweden. Continuing focus by the EC may encourage the member states to undertake studies with the objective to understand the structure of the maritime cluster in each country, which will help to formulate pro-active economic policy measures. The precarious competitive situation in the European shipbuilding sector warrants such an approach as, for example, the impact and costs of a non-intervention policy can easily be calculated across the entire European cluster. The LeaderSHIP 2015 initiative of the European shipbuilders and the studies undertaken in this context, are examples of a pro-active attitude. If all 11 maritime sectors would initiate this on a European level, it would lead to an accurate European Maritime Cluster definition and economic model. It can be done, as the example of the Netherlands illustrates. Without an overall insight into the importance of the cluster, it will be difficult to define an industrial policy for the sectors and the cluster as a whole. Understanding the maritime cluster is a condition for any policy measure and is therefore a basic building block enabler.

Define an industrial policy

On January 22, 2003, the EU commissioner responsible for Enterprise and the Information Society, made a statement on *Industrial Policy in an enlarged Europe* before the ITRE Committee of the Industrial Policy Communication of the European Parliament[14]. This policy had been adopted by the Commission on December 11, 2002. One of the central aims of the policy is to place industry back on the policy agenda. The Communication also opens the way to a more in-depth exploration on how the different EU policies interface with the performance of European industry and to examine what should be done to reinforce the competitiveness of EU companies. The prevailing policy framework for industrial policy dated from 1990. A number of trends that affect industry have recently been intensified.

Firstly, globalisation, which forces the Union to make itself a more attractive location for investment. Action is needed to reverse the relocation tendency displayed by many

[14] http://europa.eu.int/comm/enterprise/speeches/index.htm

of the research and productive activities outside the EU. Secondly, fast technological change. Enabling technologies like ICT, when accompanied by new organisational techniques and a skilled labour force, can have far-reaching implications raising the productivity in all industries around the world. Thirdly, growing expectations from society, such as environmental, consumer and health protection, which place additional demands on industry. On top of these changes, the EU's productivity growth, vis-à-vis that of the main competitors, has been disappointing. It is worth noting that, as far as productivity is concerned, the manufacturing industry does far better than the EU economy as a whole. In the face of these developments, it is manifest that the EU is not fully on the right track towards the Lisbon objectives. Within the framework of the broader Lisbon process, the EU policies should focus on how to increase the competitiveness of the industry. Without a vibrant and competitive industry the EU will not attain the Lisbon goals.

The commissioner responsible for Enterprise and the Information Society, has five main messages to improve the situation.

- The first message is a simple one: ***industry matters.*** Industry needs to be placed back at the core of the EU policy concerns and stay there. In recent decades, there has been a contraction in manufacturing's share of overall output, and a corresponding increase in the share of services. This created the impression that manufacturing industry was no longer important for overall competitiveness and sustainable development. In fact, this is a mistaken assumption: manufacturing industry plays a key role. It is actually the rise in manufacturing productivity that, through the resulting sustained increase in wealth, has indirectly led to growing demand for services (leisure, tourism, etc.). The contraction of manufacturing has also been partly the result of increasing outsourcing by industry. Many of the services outsourced, already existed, but used to be counted as part of manufacturing. Thirdly, manufacturing and services are closely interconnected. A strong manufacturing industry drives the growth of the services sector and is therefore as important as ever in the knowledge and the services economy.

- ***Enlargement, despite real challenges, is an opportunity.*** Industry in both the EU-15 and the accession countries has already to a large extent anticipated enlargement: this has been reflected in trade and investment flows for years. This process of economic integration will be reinforced as enlargement becomes a reality. Overall, enlargement will be a major opportunity for industry in new and existing Member States alike. A wider market will open up access to a broader choice of production factors and a wider customer base (accession of ten new Member States will enlarge the internal market by 75 million people). Enlargement will also ensure that accession countries, benefiting from greater perceived political stability, continue to attract large inflows of investment. EU companies are already the largest source of foreign direct investment in accession countries. Last but not least, enlargement provides opportunities for industry to reorganise value chains drawing from a large pool

of low-cost highly-skilled labour from the future Member states. Competitive reorganisation of value chains will allow the enlarged EU to retain economic activities which otherwise would be relocated further East. Enlargement will also entail certain challenges. Policy-makers will need to address a number of specific issues in the accession countries. These issues are, for example: fostering entrepreneurship and the growth of SMEs. Young enterprises have developed only slowly in accession countries; promoting investments in infrastructure**;** completing restructuring in certain traditional sectors such as steel or *shipbuilding*, or fostering the emergence of *innovative business clusters* (i.e. through the development of production networks including present and future member states).

- ***A balanced approach to the three dimensions of sustainable development needs to be ensured.*** The sustainable development strategy adopted at the Gothenburg European Council in 2001, hinges upon simultaneous progress in its three pillars: economic, social and environmental. All the three are important. If one is weak, sustainable development will not be achieved. The Commission's aim is that environmental, social and economic objectives progress in parallel, feeding into each other. Industrial policy for instance, through stimulating sustainable production, can make an important contribution to a cleaner environment. In turn, pursuing environmental objectives can lead to the emergence of new markets or the development of newer technologies, to the benefit of European companies.

- ***All the synergies between the various policies that have an impact on competitiveness need to be exploited.*** *Article 157 (Illustration 9) of the Treaty provides that all community policies have to contribute to industrial policy objectives*. Indeed, most policies have an impact on the business environment and influence the competitive performance of companies: regional policy, education, employment policy, taxation, consumer protection, competition, trade or even apparently unrelated fields, like justice and home affairs. Innovation and entrepreneurship, for instance, have been identified as two key drivers of competitiveness and will play a central role in the industrial policy. The Commission has launched an internal screening exercise, with a view to identify how every policy, while aiming to achieve its own objectives, can maximise its synergies with industrial policy.

- ***Industrial policy, while being horizontal in nature, needs to take into account the specific characteristics and needs of every individual sector.*** The frameworks, institutions and instruments in which business operates are highly sector-specific. One does not regulate and approach aerospace in the same manner as pharmaceuticals. This type of policy intervention needs to draw on a very solid and comprehensive knowledge of the particular characteristics of the sector in question. Developing analytical tools and increasing the knowledge of the functioning and the dynamics of individual sectors, will become the first step of our methodology. To this end, the detailed assessments of the

> competitiveness of individual industry sectors will be intensified. These in-depth analyses, will be complemented by broad consultations of all stakeholders. Broad consultations allow policy-makers to better understand the complex mechanisms behind the competitiveness of given sectors. In any case, the policy toolbox should include not only instruments specific to industrial or enterprise policy, but, when deemed necessary, count also on the contribution of other policies.

This policy statement from the EU Commissioner provides the formal basis for the clustering of sectors in individual countries and at the European level, as well as, the development of an industrial cluster policy. Within the framework of such a policy more sector specific measures could be defined. It is very clear that such a set of policies will become ***the*** enabler of the European maritime cluster.

Illustration 9: Treaty of the European Union

TITLE XVI (ex Title XIII): Industry

Article 157 (ex Article 130)

1. The Community and the Member States shall ensure that the conditions necessary for the competitiveness of the Community's industry exist. For that purpose, in accordance with a system of open and competitive markets, their action shall be aimed at:
   a. Speeding up the adjustment of industry to structural changes;
   b. Encouraging an environment favourable to initiative and to the development of undertakings throughout the Community, particularly small and medium-sized undertakings;
   c. Encouraging an environment favourable to co-operation between undertakings;
   d. Fostering better exploitation of the industrial potential of policies of innovation, research and technological development.
2. The Member States shall consult each other in liaison with the Commission and, where necessary, shall co-ordinate their action. The Commission may take any useful initiative to promote such co-ordination.
3. The Community shall contribute to the achievement of the objectives set out in paragraph 1 through the policies and activities it pursues under other provisions of this Treaty. The Council, acting unanimously on a proposal from the Commission, after consulting the European Parliament and the Economic and Social Committee, may decide on specific measures in support of action taken in the Member States to achieve the objectives set out in paragraph 1. This Title shall not provide a basis for the introduction by the Community of any measure which could lead to a distortion of competition.

Strengthen demand pull sectors

All maritime sectors are relevant for the industry, but the demand pull sectors, such as shipping, are even more important. The individual countries and the EU as a whole, may consider to strengthen the shipping sector, as this sector is not only strategically important for the external and internal seaborne trades, but European shipowners have a discretionary power to build ships at European yards, or in case the ships are build outside Europe, to specify (high value added) European marine equipment. The successful marine equipment exports of several countries, as a result of the role of shipowners (for example Norway), shows that this strategy works.

The European shipowners control some 40 percent of the world fleet. A major part of this fleet is currently registered in flag states outside Europe. The EU countries could

take the necessary measures and create the conditions in such a way that shipowners repatriate their foreign flagged vessels to the national registers. This will boost ship management and other maritime services in the short-term. It will also strengthen the EU flag states position in all regulatory bodies, like the IMO. At the same time, it positively affects the work of Port State Control and the European Maritime Safety Agency, as substandard ships and owners are less likely to operate out of European quality registers. In the long term the massive in-flagging of ships to EU registers will result in more maritime related activities in Europe and a strengthening of the maritime cluster as a whole.

The other five demand pull sectors, apart from shipping, are inland shipping, offshore, naval, fisheries and dredging. Many European-owned offshore vessels (rigs etc.) are currently registered outside Europe. The conditions could be created at the country and/or European level, to induce the owners of offshore vessels to return to the national pavilion. This will require some creative and daring policy measures as have been taken in the shipping sector. The globalisation of many industrial sectors will force governments in Europe to adopt new strategies.

The demand pull sectors are the enabling sectors within the maritime cluster. The successful development of the Norwegian International Ship Register (*Illustration 4*), since its inception in 1987, illustrates the importance of demand pull drivers for the entire maritime cluster in a country. The introduction of the new shipping policy in the Netherlands in 1996 demonstrates clearly the self-reinforcing nature of shipping: new shipowners bring new ships and this has a positive effect on the attractiveness of the cluster and the country, and it generates employment. The case of the Netherlands is briefly described (*Illustration 10*).

Illustration 10: Dutch ship register development[15]

Figure 92 shows the development of the number of ships owned by shipowners based in the Netherlands, by flag of registration, over the nine-year period 1995-2003. The new shipping policy became effective as of January 1, 1996, and the impact was rather minimal in that same year, as shipowners had to explore its consequences and qualify for the tonnage tax system. The following year, the number of ships under the Dutch national register started to grow and it has been doing so ever since. The number of ships registered under foreign flags also started to rise in recent years. This is an interesting phenomenon, as it is caused by the positive effect of the new shipping policy. Foreign shipowners that bring a ship under the national register, discover that the shipping climate, or better the maritime cluster climate, is favourable and they decide also to manage their foreign flag ships out of the Netherlands. The recent decline in 2003 of the number of ships under the Dutch flag has been a result of the success of the policy. This may seem a paradox, but the lack of qualified captains with the Dutch nationality, a condition for Dutch registration, constrained the further growth. This constraint has recently been removed and now foreign nationals can become captain, only when no Dutch captains are available.

The number of registered shipping companies in the Netherlands is 700, of which a large number of single ship companies, for legal purposes. There are 220 companies with operational substance, an increase of 20 percent since the introduction of the new shipping policy in 1996.

[15] source: speech by drs. A. Korteland, chairman Royal Netherlands Shipowners Association, KVNR, 4.10.2003

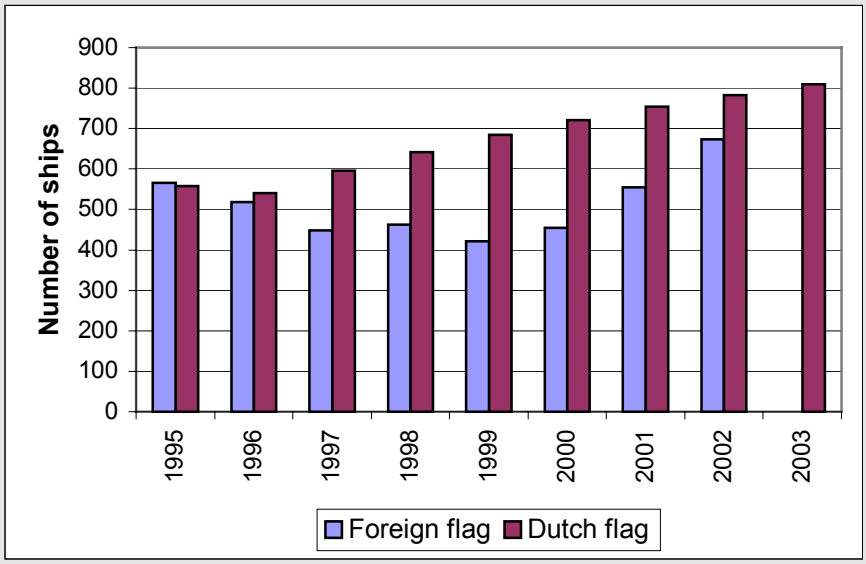

Figure 92: Number of ships under Dutch and foreign flag[16]

The employment on board the Dutch flag fleet increased sharply with 54(!) percent as *Figure 93* illustrates. The growth of Dutch nationals (mostly officers) was modest but positive, while the real growth was with non-EU seamen. The Dutch have invested heavily, like the Norwegians in improving the quality of these non-EU crews. Highly qualified foreign seamen are a condition for the further expansion of the shipping sector in the Netherlands. The value added by these foreign crews, is transferred abroad, but this is only a fraction of the value added on land by the operational and commercial shipping companies that work out of the Netherlands. The study, which led to the new shipping policy, showed that 70 percent of the value added by shipping was created on land, and only 30 percent on board the ships. The value creation from a strong shipping sector in the rest of the maritime cluster and the economy as a whole, compensates largely for the reduction in value added because of foreign labour.

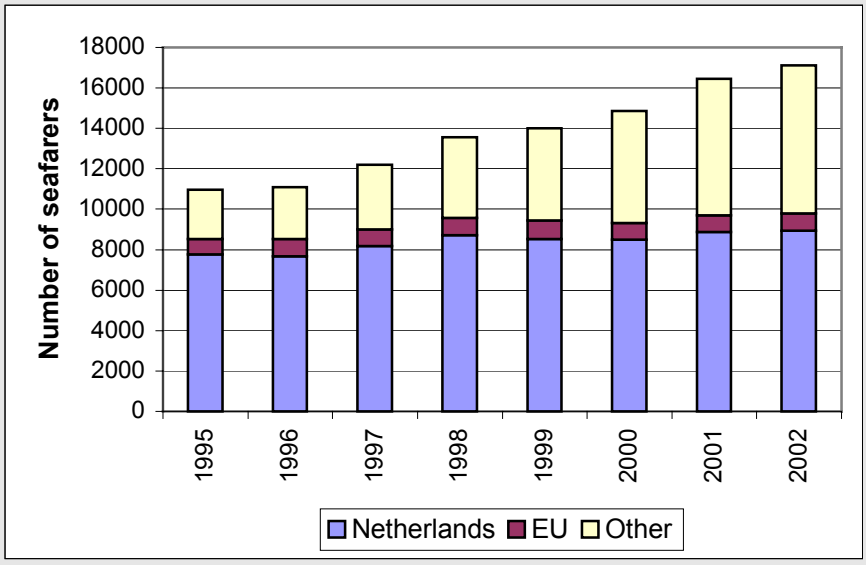

Figure 93: Number of Seafarers on the Dutch Fleet

The Dutch shipping policy can be further amended in the future to induce shipowners to register all their ships under the national register. A number of bottlenecks can be removed and a number of incentives can be created to achieve this. Bottlenecks in the domain of categories of ships that qualify

[16] as off January of each year. Over 2003 no data is available on foreign flag ships

for the tonnage tax system (for example, survey ships and cable laying ships), and a more efficient and market oriented shipping inspection. Incentives in the form of exemption of national flag ships from port state control inspections in Europe, or a reduction in pilot and port costs. This may raise the quality standard in shipping and it will finance itself as it reduces the outlays necessary to repair the negative effects of substandard shipping.

Monitor and maintain a level playing field

The severe distortion of competition in the shipbuilding sector has been discussed in *Chapter 5*. It is up to the national governments and the European Commission to monitor unfair competition and to devise measures to ensure a world wide level playing field. This also means access to foreign markets, as is sometimes not the case in shipping, for example inter-coastal shipping (cabotage) in the USA, or dredging of ports and harbours in the USA or Japan, offshore markets, and so on. The European Commission has defined five policy areas to maintain a level playing-field in Europe. These are: antitrust, mergers, liberalisation, state aid and international matters[17].

What is the position of the EC, for example, on state aid? State aid that distorts competition in the Common Market, is prohibited by the EC Treaty. By giving certain firms or products favoured treatment to the detriment of other firms or products, state aid seriously disrupts normal competitive forces. Neither the beneficiaries of state aid, nor their competitors prosper in the long term. Very often, all public subsidies achieve, is the delay of inevitable restructuring operations without, helping the recipient actually to return to competitiveness. Unsubsidised firms, which must compete with those receiving public support, may ultimately run into difficulties, causing loss of competitiveness and endangering the jobs of their employees. Ultimately, the entire market will suffer from state aid, and the general competitiveness of the European economy is imperilled. The EC Treaty, however, allows exceptions to the ban on state aid where the proposed aid schemes may have a beneficial impact in overall Union terms. Article 87 of the EC Treaty allows the following forms of aid: aid having a social character, granted to individual consumers; aid to make good the damage caused by natural disasters or exceptional occurrences; aid designed to promote the economic development of underdeveloped areas, promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State; facilitate the development of certain activities or areas, promote culture and heritage conservation.

Article 87 of the EC Treaty prohibits any aid granted by a Member State or through State resources in any form whatsoever that distorts or threatens to distort competition by favouring certain firms or the production of certain goods. The aid in question can take a variety of forms as, for instance: state grants, interest relief, tax relief, state guarantee, or holding provision by the state of goods and services on preferential terms.

The decision, as to whether or not aid granted by Member States is compatible with the Common Market, can be taken only by a supranational and independent authority.

[17] http://www.europa.eu.int/comm/competition/index_en.html

Exclusive authority for scrutinising the state aid schemes of EU governments, was conferred on the European Commission by the Member States. The Commission's role is to monitor proposed and existing state aid measures by Member States to ensure that they are compatible with EU state aid legislation and do not distort intra-community competition. The Commission has the power to require that aids that were granted by Member States but are incompatible with the common market, are repaid by recipients to the public authorities that granted it. The Member State must recover the aid immediately in accordance with domestic procedures. The Commission has adopted a number of *guidelines* or *frameworks* to clarify its State aid policy in a number of areas, such as: regions lagging behind in terms of development, research & development; employment, protection of the environment, rescue and restructuring of firms in difficulty. The Commission has also adopted a number of *block exemption* regulations for state aid to: small and medium-sized enterprises, aid for training, aid for employment.

European maritime trade organisations may play an important role in monitoring the level playing field in their respective sectors. The successful initiative of the European shipbuilders (CESA) in mobilising the Commissioner for Trade, in the WTO procedure against South Korea may inspire them. The *LeaderSHIP 2015* initiative, which also has a taskforce on aid for consolidating and restructuring of the European shipbuilding industry, may inspire other trade organisations to do likewise.

Another tool could be the ***EU Market Access Database***, from the DG Trade[18]. The database can be searched by country and sector. A random example, illustrates the type of information available. Selecting the country *Japan* and the sector *shipbuilding*, turns up an interesting item for fishing vessel engines (*Illustration 11*).

Illustration 11: EU Market Access Database

980122- Engines for fishery vessels [2001-07-26]

With regard to engines for fishery vessels, there is a unique regulation in Japan defining the type of engine to be installed in relation to the size of the vessel. This regulation is over 30 years old and is no longer in step with modern developments. What is more, it is not in line with international standards (ISO). Under the regulation, the calculation of the maximum engine size allowed for fishery vessels is based on the so-called Gyosen-Ho Bariki, which is translated in this document as Engine Performance Index (EPI). Under the EPI, the calculation method for maximum engine size is artificial in that it does not measure actual engine output (which would be in line with international standards (ISO 8665, 1998)) but output on the basis of the approximate engine displacement. This represents a significant regulatory obstacle for European companies, as they are not optimised under EPI. Furthermore, actual engine output is a far better criterion for regulating engine size in view of protection of fishery resources, fuel consumption, environmental aspects and maintenance costs. The relevant Japanese regulations were modified in August 1997. However, there has been no change in practise to the regulatory environment, with the Ministry of Agriculture, Forestry and Fisheries continuing to use EPI for the calculation of maximum engine size for fishery vessels. The reason given for the existence of this regulation by the Ministry of Agriculture, Fisheries and Food (MAFF) is that it was designed to limit the power of fishing boats, as an instrument of fisheries policy. The European Commission does not wish to dispute MAFF´s fisheries policy aims. However, it should be noted that it is questionable whether the regulation as now constituted, is an effective means of limiting the power of fishing

[18] http://mkaccdb.eu.int/mkdb/stb/mkstb.pl

vessels. In the ten years from 1986 to 1996, developments in engines available on the market have meant that the actual power output of an engine complying with a certain EPI figure has increased by two thirds.

In the framework of the Regulatory Reform Dialogue the Commission's objective was the modification of EPI in line with international (ISO) standards based on real engine output. At the end of March 2001, the Delegation reported that the MAFF/FA had accepted the EU proposal to use kW in order to measure marine engine output for fishery vessels. The enforcement regulation will be implemented as of April 1, 2002. However, the new system will be applicable for those engines that are registered after the date of implementation. The current system and the inspection methods will continue to be valid for the engines that have been registered prior to this date, including those that have been in use at sea.

The international trade organisations could encourage their members and companies actively to formulate market access problems. If these are not clearly exposed, there is no way for the EC to take adequate actions. Monitoring market access problems and maintaining a level-play field is an important enabler of maritime clusters in Europe and should be a cornerstone of a new European Maritime Cluster Policy.

Promote internal market, exports and internationalisation

The maritime sectors in Europe can be stimulated to develop the internal market further. As most trade barriers have come down, companies can take advantage to export to other EU member states. In particular the expansion of the EU with ten new member states by May 2004, will increase the export potential. Apart from that, exports to countries outside the EU may be stimulated and all trade agreements of development assistance programmes can be used to promote maritime exports. Maritime investments, like ports and shipping, often enable developing countries to participate in the global market place, and are a precursor for economic growth. The member states and the EU can make better use of the many international agreements and assistance programmes to promote the maritime sectors and their exports.

In the long term, strong export positions are difficult to maintain, as major imbalances in trade may disrupt international trade. Therefore, companies have to internationalise their production and service activities, making use of lower factor costs in these countries outside the EU. Access to foreign markets and foreign investments could be monitored.

Many member states do not monitor outgoing foreign direct investments on a systematic basis. However, this clearly signals the transfer of activities and jobs abroad. Not only within the EU, but more importantly outside the EU. The mega-shift of industrial companies (for example automobile industry) from the EU-15 countries to the former East-European countries, will have severe consequences for the viability of the other sectors in the cluster. The decline or shift of the shipbuilding sector will impact the marine equipment sector and the maritime services sector as well. This will reduce the dynamics in the maritime cluster and may lead to stagnation, for example, in the offshore or naval sectors.

Monitoring and promoting exports to the member states and to countries outside the EU, as well as the stimulation and monitoring of internationalisation and outgoing foreign direct investment, are important EU enablers of the maritime cluster.

Strengthen innovation, R&D and leader firms

The development of a European innovation policy and its promotion, is embodied in the overall framework of the Enterprise DG policy, as from January 2000, while continuing to be one of the main objectives pursued in the RTD framework programmes. The strategic goal for the European innovation policy was set at the Lisbon summit of the European Council in March 2000. The Summit's conclusions draw attention to two requirements. The maximum benefit for innovation should be extracted from Member State and Union-level research, and a friendly environment has to be created for starting up and developing innovative businesses.

As a follow-up, the Commission has set broad policy lines and five priority objectives, to enhance innovation in Europe. Main features of these objectives are:

- Coherence of innovation policies (co-ordinate and benchmark national innovation policy performance and good practice),
- A regulatory framework conducive to innovation (avoid over-regulation, lower the cost of doing business and reduce red tape),
- Encourage the creation and growth of innovative enterprises (improve environment for innovative start-ups),
- Improving key interfaces in the innovation system (effective operation of interfaces between companies, investors, researchers, training institutions, advisory services etc.),
- A society open to innovation (awareness and dialogue between all actors, including the general public).

Cooperation within the maritime cluster is necessary, in order to make innovation, and research and development visible in the EU, and to stimulate companies to report in their annual reports the investments in these domains. Many EU programmes are geared to the SMEs as these companies are not able to innovate or participate in national, and EU research and technology development projects. A lot of effort and energy is put in the SME direction, with mixed results. As innovation in the maritime sectors often requires major systems innovation, in which a lot of suppliers cooperate and have to be co-ordinated, a better strategy could be to stimulate and strengthen the maritime leader firms to take up this innovation integrating role. This would mean a choice for the bigger companies, instead of the many smaller ones as a focal point of maritime innovations and RTD. This could lead to better results, but politically such policy might be faced with some hurdles. The European Commission might start a pilot project with a maritime leader firm innovation policy. Anyway, the dynamics of innovation and leader firms are two important enablers of maritime cluster dynamics.

The *Community Research and Development Information Service (CORDIS)*[19] web-site service offers extensive information, documentation and interactive services on innovation. The *Innovation & Technology Transfer* special edition, entitled *A Directory of European Innovation*[20], gathers key contact information covering innovation-related resources provided by the Commission, national authorities responsible for innovation support and key networks of regional innovation service providers. It is intended as a tool for networking and service access, both for established innovators and for newer members of the European innovation community.

Education and labour market

Education and labour market issues are, to some extent, responsibilities of the individual member states and not the domain of the EU. There are, however, two special categories, nautical and marine engineering, that require possibly a European policy, as these professions form the basis of the maritime knowledge within the maritime cluster. The number of students at nautical academies, technical institutions or universities, is very small in relation to other faculties, while the educational infrastructure is expensive. Reduction of budgets by the educational institutions may lead to a situation whereby the critical mass disappears and faculties and training schools may be closed. The member states could develop a pan-European plan to support the individual member states efforts to maintain and modernise nautical and marine engineering institutions. As specialised maritime knowledge is and always will be an important enabler of the maritime cluster.

9.3. Plan of action

The enablers at the company level, can be translated into enablers at the maritime cluster level, which in turn can be translated into enablers at the European maritime cluster level. In order to achieve the objectives, a comprehensive plan of action is necessary in which all the stakeholders at the company level, national trade organisation and government level, and the international trade organisation and EU level, participate.

It is proposed to start with the creation of a strong maritime cluster identity in Europe (Enabler 1) and to unite those countries and organisations which have already invested in maritime cluster studies, such as Norway and the Netherlands, the United Kingdom, Germany, Denmark, Finland and Sweden. Other countries will also be invited participate. The open platform of maritime cluster organisations will define a plan of action for the EU to promote policies based on the seven cluster enablers defined in this chapter. The international trade organisations will be invited to contribute to the plan of action.

An example of the many possibilities that exist for the European maritime cluster, is presented in *Illustration 12* (Scrap and build programme for small tankers).

[19] http://www.cordis.lu
[20] http://www.cordis.lu/itt/itt-en/02-spec01/index.htm

Illustration 12: Small tanker scrap and build programme

The traditional oil tanker and bulk carrier designs have been under severe attack during the last decade. This has led to many new concepts, like the double-hull tankers or the more recent double-hull bulk carrier from O-J Libaek (*Figure 94)*. European companies have been at the forefront of these developments, which is a very important capacity to maintain. The European basic knowledge of shipping, design and construction of ships, leads to remarkable new concepts, like the double acting oil tanker (*Figure 95)* designed by Kvaerner Masa-Yards for the Arctic trades, or the sandwich hull concept for bulk carriers (*Figure 96)*, developed by DNV Research and shipbuilder Aker-Kvaerner.

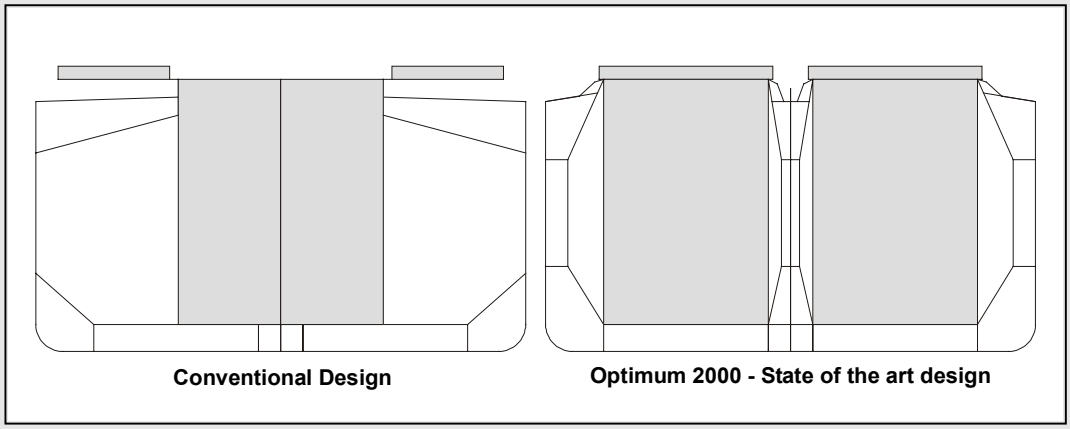

Figure 94: Double-hull bulk carrier design [109]

Figure 95: Double acting oil tanker Tempera: sailing with the stern forward in ice [108]

The EU could stimulate the further development of these concepts and use them to create a competitive advantage for the European shipping and shipbuilding industries. The market for double-hull bulk carriers may still take some time to develop. It may be speeded up by further catastrophes as have happened in recent years, at a cost of many human lives. This process has already been gone through in oil tanker shipping, where double-hulls are now a world-wide requirement for larger tankers. The majority of tankers in the world fleet consists however of small tankers, of under 10,000 dwt. These are currently almost all single-hull tankers and there does not exist a large scale replacement programme. This in spite of the staggering number of ships and the very old age of more than 21 year on average, as *Table 38* illustrates.

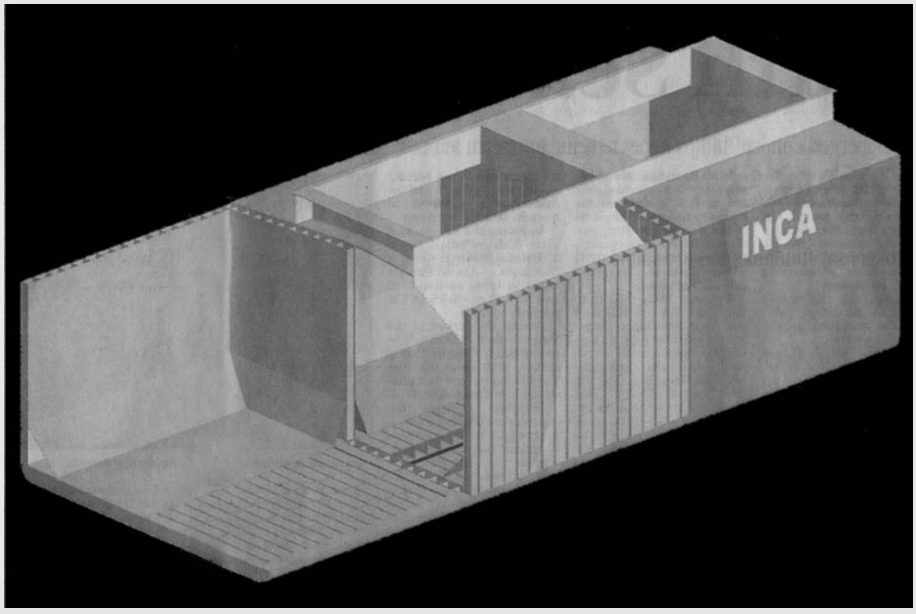

Figure 96: Sandwich hull: steel plate cell structure, filled with light weight concrete [62]

Age class	<1976	1977-1981	1982-1986	1987-1991	1992-1996	1997-2001	Total
Number	1579	734	521	422	584	304	4164
Dwt (*1000)	3888	2182	1921	1453	2084	1481	13008
Average age (years)							21.9

Table 38: Oil tankers <10.000 dwt [33]

A scrapping scenario, based on the compulsory phase-out of single hull tankers, has been presented by shipping consultant Fred Doll (Lloyd's List 8.10.03). *Figure 97* illustrates the annual volume (deadweight) of small tankers up to 2010. This is clearly an opportunity for European shipyards.

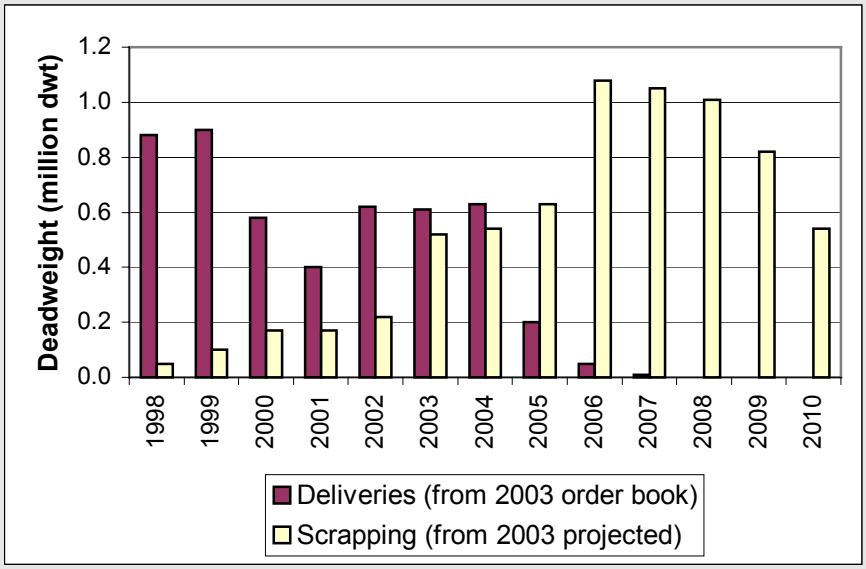

Figure 97: Scrapping scenario for small oil tankers 2003-2010

The EU shipyards can be competitive in small tankers construction. The combination of the environmental need to replace these tankers and the innovative design and construction possibilities, as developed by European companies, could lead to a EU Scrap-and-Build Fund, to help the European shipowners, shipyards and marine equipment suppliers to capitalise on these opportunities.

In fact, the current order book of tankers between 5,000 – 10,000 dwt, shows that European yards are already grabbing a major part of the new building market, as *Figure 98* illustrates.

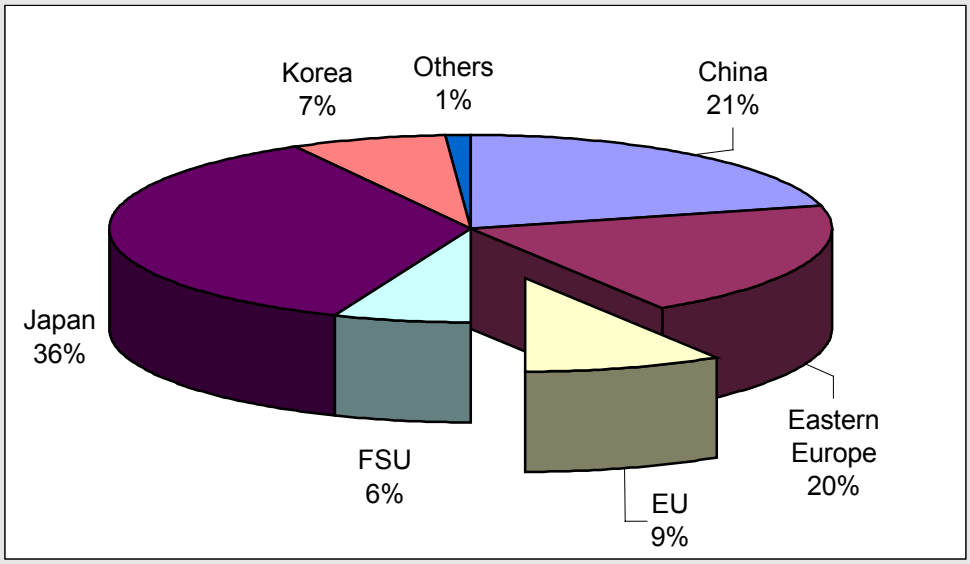

Figure 98: Order book tankers 5,000-20,000 dwt class (% based on dwt)

A similar opportunity exists in the segment of chemical tankers. There are many old tankers, with cargo tanks in the double sides. In fact, these are single-hull tankers, which should be treated as oil tankers. There are 900 chemical tankers in the world fleet, with a deadweight under 5,000 tonnes and an average age of over 18.6 years. More than 200 of these tankers are owned by a shipowners within the EU. A EU scrap-and-build programme could trigger a major newbuilding and innovation initiatives by European shipowners, with a corresponding improvement in the environmental standards. The European yards could greatly benefit from such an initiative as they are specialised in smaller ships. Italy has obtained the approval of the European Commission on the 17th July 2002 to implement an aid scheme in order to reduce the number of single-hull tankers older than twenty years, in the Italian tanker fleet, and thus limit the risk of environmental pollution. The aid is intended to compensate the shipowners for the early demolition of their ships. The aid amounts to €130 per deadweight ton with a maximum of €3.9 million per vessel. This Italian scrap and replace scheme could be a model for other countries in Europe.

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APPENDIX 1

A. Norwegian Research Projects

Title	Data
The regional maritime Norway. A vital industry with regional distinctiveness [32]	Secondary statistics and 700 interviews with leaders in the industry in 9 regions. Separate regional studies were conducted in each regions.
Competitiveness in Norwegian shipping [97][128]	Qualitative interviews and a comprehensive analysis of secondary statistics
The maritime sector in Norway seen from a cluster perspective [5][96]	A survey of 220 respondents in the maritime industry and an analysis of secondary statistics.
Trust in network organisations [66]	Case study, qualitative interviews
Organisational culture and change in Norwegian shipping firms [119]	Three case studies, qualitative interviews, observation
The Norwegian maritime environment [78]	16 qualitative interviews and analysis of secondary statistics
Competence as an international competitive advantage [10]	33 qualitative interviews and an analysis of secondary statistics
Organisational and inter-organisational factors that promote innovation in shipping [43]	A survey of 64 shipping firms
Future development in shipping and its markets [68]	An analysis of secondary statistics by 42 researchers
Shipping firms, innovation, and competitive advantage [44]	Eight qualitative interviews of experts and CEOs
Attracting the Winners. The maritime competitiveness of five European countries [39]	A survey of 483 companies in 5 countries and in dept analysis of secondary statistics

Source: [46]

B. The NACE categorisation

Ship building

35100 Building and repairing of ships and boats (155 companies)
35110 Building and repairing of ships (102 companies)
35111 Building and repairing of ships and hulls more than 100 g.r.tons (64 companies)
35112 Installation- and completion work on ships more than 100 g.r. tons (13 companies)
35113 Building and repairing of ships less than 100 g.r. tons (69 companies)
35117 Ship breaking (1 company)

Shipping companies

61000 Water transport (32 companies)
61001 Shipping operations
61100 Sea and coastal water transport (70 companies)
61101 Ocean transport (26 companies)
61102 Coastal water transport in Europe (5 companies)
61103 Unscheduled transport in Norwegian coastal waters (3 companies)
61104 Scheduled long distance inland transport in coastal waters (3 companies)
61105 Domestic ferries

61106 Tugs and supply vessels in norwegian coastal waters (3 companies)
61109 Other coastal water transport in norway (2 companies)

Shipping consultants
742092 Shipping consultants

Suppliers
29120 Manufacture of pumps and compressors (38 companies)
29111 Manufacture of marine engines and parts (17 companies)
29221 Manufacture of marine lifting and handling equipment (20 companies)
51652 Wholesale of shipping equipment and fishing tackle (122 companies)
516522 Wholesale shipping equipment
524898 Shipping provisions, equipment etc.
63112 Cargo handling connected to water transport (2 companies)
63220 Other supporting water transport activities (15 companies)
63223 Rescue services (2 companies)
63229 Other supporting water transport activities (30 companies)
632291 Ship cargo handling (skipsekspedisjon)
632292 Rescue and diver firms
71220 Renting of water transport equipment (1 company)

Other services
63402 Ship brokerage services (107 companies)

C. Maritime cluster in the regional study

The researchers applied the following method: The starting point was the NACE-codes. Then the researchers excluded some companies that for different reasons did not belong to the maritime cluster in the regions. Thereafter the researchers added companies without the selected NACE-codes which they believed belong to the cluster. The result of this process gave a different sector definition in the value creation project than in the regional project. Also, in the regional project the sector definitions applied in the different regions were not similar. For instance, in southern Rogaland the offshore supply industry is included and in northern Norway the shipowners of the fishing fleet are included.

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