

WORLD MARINE MARKETS

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1. INTRODUCTION & DEFINITIONS

1.1. Introduction

This report was commissioned by the WTSH, Kiel, and completed in March 2005. It examines the sectors that constitute the world marine industry and values each sector over the period 1999 to 2010.

Where possible we also give our views on segmentations by region. However, it is very important to note that the marine industries are truly global businesses.

There are major variations in the amount and quality of data available on the various sectors and different sources often give different values. Also, as these statistics are often provided by organisations on a voluntary basis, in many instances complete time series do not exist.

A further complication is that companies often operate across several sectors and official attempts to categorise a company by using a single standard industrial coding only lead to more errors. This is why for most sectors there are no reliable figures for numbers of enterprises or employees.

In many instances it is simply that no data exists for the marine industries.

In light of the above, where possible we have had to resort to building models of sectors.

In general we do not seek to give values for Germany or Schleswig Holstein as valuation of these are the subject of separate work by BALance and MC.

This report summarises the results of our work and is accompanied with an Excel file that contains the detailed tables of forecasts.

1.2. Definitions

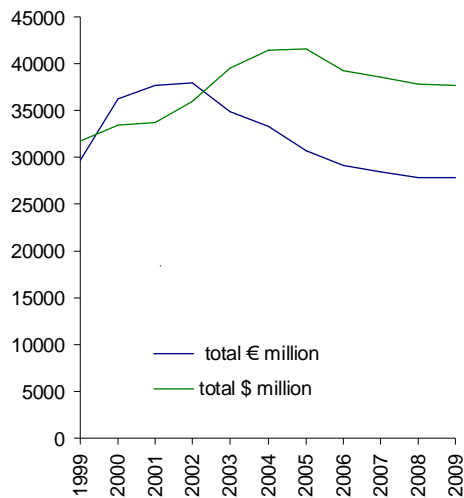


Figure 1-1: Shipbuilding Expressed in € and \$

Exchange rates – The marine market is an international industry and in many cases expressing the value of sectors in Euros presents a false picture of markets as activity in the marine industries is mainly denominated in US dollars.

Between 2002 and 2004 the US dollar has fallen and the Euro risen against major currencies. The effect can be to change a market that has grown in US dollars into a decline when measured in Euros.

We use actual historic exchange rates throughout this report and December 2004 rates for forecasts.

There is a great **shortage of data** on the sectors. Where available, statistics are often based on voluntary contributions and therefore often incomplete. The most useful information is often that produced by national trade organisations. As other researchers have noted, more than half of the maritime sectors identified are not covered by official European statistics and the situation becomes worse when data is required for individual countries and world markets. When data is available, it is often in units (such as tonnage) and not € values. Internationally comparable official statistics are often out of date, with data available in early 2005 often relating to 2002. This presents a particular problem due to the considerable increase in activity in many marine sectors during these years.

In a number of instances (shipping, offshore oil & gas and renewable energy are examples) we use our own models of historic and forecast global activity.

The marine industries operate in a global market and vessels are registered in locations that present their owners with lowest costs of compliance with regulations. In addition, a number of companies in the ship owning, shipping and ports sectors are privately owned and structured to assure privacy and do not issue annual reports giving values of sales and profits. So **secrecy** is another factor that contributes to a lack of data on national and global market values.

There can be considerable variations in what constitutes the **value** of a market sector. In some instances such as the marine fisheries sectors, shipbuilding, etc., we use the value of production, in others the capital and operational expenditure. In general, we are considering ‘markets’ and not the economic benefit to the country which is often a multiple of the stated market.

It is important to note that sector values cannot always be added as in many instances this would cause of **double counting**.

Our primary aim in the report is to produce a world market value for each sector and its **regional segmentation** – in practice this can be difficult to achieve. In the case of Europe, difficulties arise due to the enlargement of the European Union and lack of data. Also information on the Former Soviet Union is very difficult to obtain.

The **definition** of what constitutes a sector varies from source to source and is often unstated. The result is that information relating to one country is not directly comparable to that from others. Other countries may apply different structures and definitions of the marine industries, therefore the figures we present in this report cannot necessarily be applied to markets accessed by another country. The definitions we use in this report are given below.

Table 1-1: Marine Sector Market Value Definitions (listed by total value 2005-2010)

<i>Sector</i>	<i>Definition</i>
Shipping	UNCTAD estimate of the percentage of total seaborne trade.
Marine Tourism	All expenditure, excluding travel and accommodation.
Offshore Oil & Gas	Total capital and operational expenditure. (<u>Not</u> the value of the produced product which is considerably greater.)
Seafood Processing	Output value of processed seafood (fish and shellfish).
Marine Equipment	Equipment used in commercial ships.
Fishing	Value of fish and shellfish landings as defined by the FAO.
Shipbuilding	Value of ships based on vessels =>100GRT.
Naval Shipbuilding	Expenditure on building naval ships.
Ports	Port revenues based on average prices per tonne of cargo handled.
Marine Aquaculture	Output value of 'farmed' fish and shellfish as defined by the FAO.
Yacht & Boatbuilding	Sales of new leisure boats.
Cruise	Revenues of cruise vessel operators.
Research & Development	Expenditure on academic and commercial R&D.
Marine Services	Professional services to the shipping sector. Excludes shipowners and operators revenues.
Marine Renewable Energy	Total capital expenditure on wind, wave and tidal current installations.
Security & Control	Expenditure required by national and international authorities.
Ocean Survey	Seabed and shallow seismic survey for civil purposes. Excludes oil & gas deep seismic.
Education & Training	Academic and personnel training specific to marine skills.
Underwater Technology	Hardware & software for underwater operations. Excludes equipment for subsea oil & gas production.
Underwater Vehicle Ops.	Revenues from ROV and AUV operations.

'Other' European countries. When using this term in tables and charts we are usually referring to the summation of values for the following:

- Belgium
- Croatia
- Czech Republic
- Faeroe Islands
- Greece
- Iceland
- Irish Republic
- Malta
- Slovakia
- Turkey
- Yugoslavia

2. SUMMARY & CONCLUSIONS

2.1. Background

Some major factors are presently impacting on the marine industries:

The most significant development is the growth of the Chinese (and other) developing economies which has caused increases in their demand for commodities and growing exports, resulting in a surge in world shipping, ports and marine services and shipbuilding activities.

US imports have grown dramatically and the US trade deficit worsened. Major changes in exchange rates have resulted. A 39% rise in the value of the € against the \$ has significantly undermined Eurozone companies' competitiveness in world markets.

The Chinese currency is widely regarded as being seriously undervalued and a significant revaluation could reduce its exports somewhat and perhaps, more importantly, boost the depressed value of the US\$.

The aging and declining workforce in developed economies and high wage costs are also pushing industries into locating production in the developing world, further increasing their exports and undermining the competitiveness of European countries.

Although there are costs for the marine industry arising from requirements to comply with environmental legislation this also generates benefits for technology providers – development of the renewable energy sector is one example. Increasing concerns over global warming have resulted in a strong growth in plans for offshore renewable energy installations, particularly wind farms.

Global terrorism and associated security needs has resulted in development of new 'markets' in provision of products and services for the marine security sector.

The strong growth in global energy demand, particularly from the developing countries has boosted the offshore oil & gas sector but increasingly raises concerns over a possible limit to oil supplies. In this event there could be major increases in transport costs which would impact upon the competitiveness of developing countries.

The interplay of the above factors means that the marine industries are going through a period of considerable changes and this seems to be the likely pattern in the future.

2.2. World Market Sectors

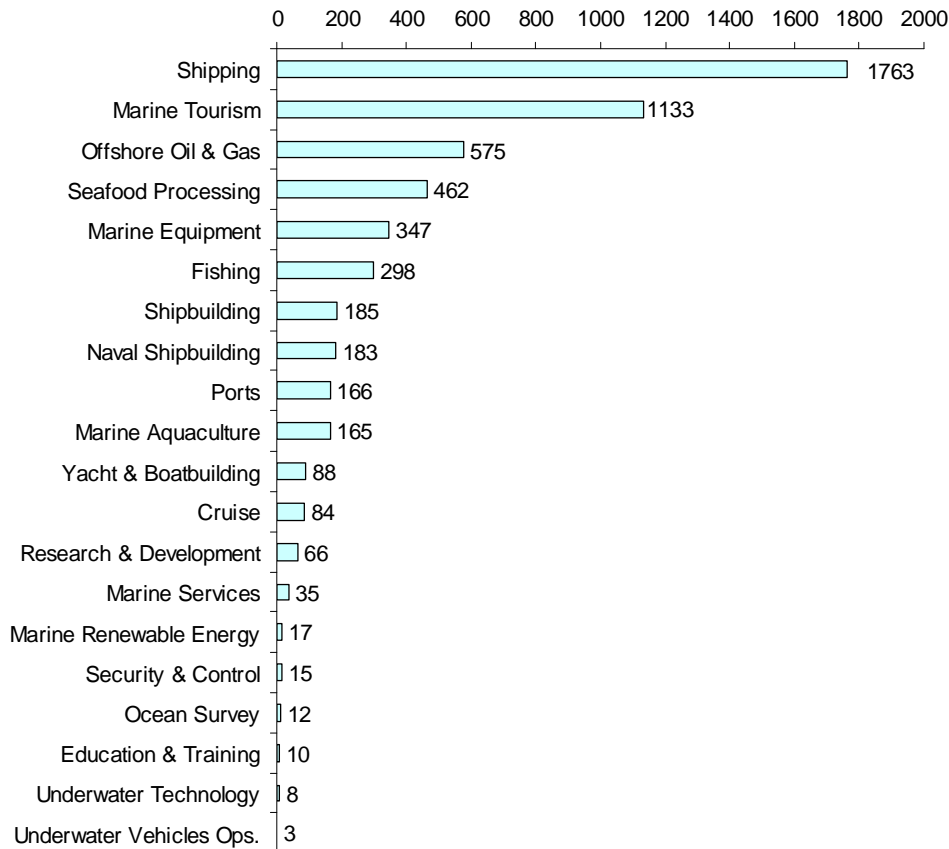


Figure 2-1: World Marine Industry Sector Totals 2005-2010 (€bn)

The largest sectors in terms of expenditure are Shipping and Offshore Oil & Gas, followed by Marine Tourism. However, the ones likely to show greatest percentage growth over the period to 2010 are the 'new' sectors of Marine Renewable Energy and Marine Security.

(The values we give below are for world markets.)

Shipping and transport (€287bn in 2005, €326bn in 2010). Within Europe the shipping cluster is estimated to comprise 10,000 companies.¹) Over 90,000 ships =>100 gt are registered worldwide and more than 50,000 are thought to be trading internationally. The UN has noted that "it is generally considered that maritime capabilities, specifically the ownership of substantial tonnage are essential for countries trade support and promotion".² It is estimated that some 90% of world trade tonnage is transported by sea and seaborne trade has grown by 400% in past 40 years. Of particular significance is the container sector set to grow by a further 400% by 2022.

Shipping is a highly cyclical industry presently enjoying an unprecedented boom. However, it is likely that by 2006 additional capacity entering the market will cause rates to fall and we expect a return to long-term trends from 2007. This falsely gives the impression of shipping and all its associated sectors as being markets in decline which is clearly not the case. Shipping is an important industry due to its high value-added nature activity – 232% within the EU.

¹ *Lloyds List* p1, 27 Jan 2004

² 'Review of Marine Transport 2003' United Nations Conference on Trade and Development (UNCTAD)

Germany has been particularly successful in developing its shipping industry. At the end of 2004, German owners controlled 2,560 ships. The fleet has doubled since the introduction of the tonnage tax five years ago.

Marine Leisure & Tourism (€174bn in 2005, €205bn in 2010). This includes a wide range of leisure activities such as sailing and boating, water sports, recreational diving, sea angling and cruise holidays. Together, these activities form the second largest marine leisure activity worldwide.

The marine leisure sector is forecast to enjoy continuing long-term growth in line with the overall growth in tourism and leisure sectors.

Marine Equipment (€57bn in 2005, €60bn in 2010). This market is comprised of the capital items of the civil and naval shipbuilding sector (e.g. propulsion systems & machinery and many other components), with over 5,000 suppliers listed worldwide. There is growing technology content and hundreds of high-tech sub-sectors many of which offer opportunities.

Germany is a technology leader in a number of areas ranging from marine electronics to ships engines.

Offshore Oil & Gas (€88bn expenditure in 2005, €99bn in 2010). The sector is benefiting from a long-term growth in demand and increased oil & gas prices. Offshore oil & gas is probably the world's largest marine industry in terms of the value of its output which we estimate at some €700bn in 2004.

Shallow water regions are now in decline (although many small fields remain) causing oil & gas companies to move to deepwater areas. Operational spend is, however, growing in most regions. As fixed platform installations decline there is an increase in floating production and subsea production. Gas is increasing in importance resulting in major investments in offshore pipelines and onshore LNG plants.

Fish/Seafood Processing (€75bn in 2005, €79bn in 2010). Processing tends to add 100% to the overall value of the raw product. The main driver is the move to convenience foods. A considerable export market exists for processed seafoods and high cost European processors such as Norway are greatly aided by establishment and development of a premium brand.

Fishing (€51bn in 2005, €48bn in 2010). This is an important industry seeing growing demand, but the world catch tonnage is falling as a result of serious resource problems and quota restrictions. There are some opportunities offered by new species, however aquaculture which is subsidized in a number of countries provides serious price competition. The industry faces a future of continuing global decline worldwide until a point of sustainability can be reached.

Shipbuilding (€33bn in 2005, €30 in 2010). This sector is experiencing a peak which will be followed by a return to long-term growth trends. Demand is shipping driven and current owner confidence has boosted orders and shipyards are full. We expect to see some decline, then a return to long term slow growth trends.

1,430 shipbuilders & repairers listed worldwide, but there is a history of over-investment and subsidy. As a result, Asia dominates the 'bulk' vessel market, but the emergence of China as a shipbuilder now threatens Japan & Korea. Europe is associated with higher tech small number series ships (cruise, offshore, etc), but the high value € has major impact on EU shipbuilders and their suppliers. Germany has an important industry which is large by European standards.

Naval Shipbuilding (€27bn in 2005, €34bn in 2010). Despite the very large US spend on naval shipbuilding, it is slightly exceeded by Europe. Asia, currently in third place is forecast to grow strongly over the next decade. There is very little data available on the value of the sector and its segmentation by country. Although the major players build their own vessels, there is a significant export business to developing countries.

Ports (€25bn in 2005, €30bn in 2010). There are over 8,000 ports & terminals worldwide of which some 2,000 are significant. However, the top-50 handle the majority of business. Increasing seaborne trade and

containerisation means strong growth in prospect and port congestion is looming. Major investments are needed in developing port infrastructure worldwide.

Ports have major economic impact which is a large multiple of revenues. Europe's largest port is Rotterdam where in 2003 5,741 persons were associated with cargo handling, but 58,739 are in 'direct port-related employment' and it is claimed that the port generates indirect employment for 250,000 people.

Marine Aquaculture (€25bn in 2005, €30bn in 2010) is experiencing a long-term growth trend partially associated with it filling the capture fishing tonnage gap but also due to low prices of its products. (SE Asia is a low cost producer and European governments subsidise aquaculture.) Norway leads European production and benefits from a strong international brand. Between 1996 and 2002 tonnage growth was 7% p.a. and \$ growth was 4% p.a. Continuing strong future growth in demand is forecast.

Yacht & Boatbuilding (€12bn in 2005, €17bn in 2010). Yacht & boatbuilding is part of the Leisure Boating sector (which includes marina operations and other operational expenditure, chandlery, motor sales, etc, but data is incomplete on this wide definition). The sector is likely to show good growth to 2010.

Leisure boating has a considerable economic impact. Within some of the European countries, the total leisure boating sector is typically 7 to 8 x the value of new yacht & boat sales.

Cruise Industry (€12bn in 2005, €15bn in 2010). The sector offers large potential with major investments being made in cruise terminals worldwide. Total economic benefit delivered by the industry is considerable. Although dominated by the US market which accounts for >70% passengers, is of note that 2.7 million Europeans took cruise holidays in 2003 and of these 2 million in European waters.³ Strong growth is expected with European passengers increasing to 4 million in 10 years. Of particular significance to Germany is the growth of smaller specialised cruises in Northern European waters.

Research & Development (€10bn in 2005, €12bn in 2010). We value shipbuilding R&D at €1.8bn and its future growth is mainly a function of future growth of revenues. The oil & gas industry is estimated to spend €2.5bn, but in future years this will increase in line with the technical challenges to be faced. Other marine industries, we believe, total €1bn.

Government is a major spender with over 1,200 'research' vessels worldwide. The USA leads and NOAA's marine budget we estimate at €2bn. Other governments probably total €3.0bn. The response to global warming is likely to increase this spend. (Our figures exclude the important military naval sector where the US accounts for \$13bn and the world total could be €26bn.)

Marine Services (€5.7bn in 2005, €6.5bn in 2010). This is a long-term growth sector with London being the world's leading centre, but its position is increasingly under threat from SE Asia (particularly Singapore). The sector ranges from ship operations, broking and insurance to specialist publications. Marine services are of major strategic importance as a successful centre tends to cluster decision makers for many associated activities.

Renewable Energy (€0.5bn in 2005, €4.7bn in 2010). This tiny new industry has the largest growth of any sector and should reach €5.6bn in 2009. 99% of expenditure will be on wind farms with 2,258 turbines (totalling 7.5 GW) forecast to be installed over the period. There is also an embryonic wave and tidal activity.

Europe will account for 85% of the forecast market. The UK market will develop first (with 26% to 2009) then if existing plans materialise it will be followed by the German market (40% to 2009). European technology leads but the challenge is to reduce costs by use of large 5 MW turbines involving increased distances from the shore and water depths. Germany is a technology leader in windpower and has great potential to grow its industry.

³ European Cruise Council 2004 (first statistics)

Security & Control (€0.8bn in 2005, €2.3bn in 2010). This is new and important growth sector that has developed following the events of 9/11. Over the period to 2010, we expect expenditure on maritime security to total nearly €21bn. Although major expenditures will be required in US ports this will continue until 2015. Costs to modify ships will form the majority of expenditure within the medium term and in addition the container shipping industry will be required to pay security inspection fees.

Ocean Survey (€1.9bn in 2005, €2.1bn in 2010) satisfies a continuing need for provision of up to date charts essential for safe navigation. Accordingly it has a long-term growth trend. The largest commercial activity is in surveys for the offshore oil & gas industry. Europe is a major player in this high tech sector which is dominated by the Netherlands.

Education & Training (>€1.5bn in 2005, €1.8 in 2010). The sector has three primary activities:

Seafarer training – 400,000 officers and 825,000 ratings are employed worldwide with 60% of the latter being from the Asia Pacific region. 418 ‘maritime schools’ are listed worldwide and there has been a 27% oversupply of ratings (mainly Philipinos). At the same time there is a 4% undersupply of officers which is expected to rise to 12% by 2010. Seafarer training costs \$5-20K, officer \$40K and we estimate over 2005-9 177,000 will need training.

Offshore Workers – these undergo safety training on a four year cycle. With an estimated 80,000 workers worldwide, some 20,000 are trained per annum.

Higher education – establishments offering marine courses total at least 241 worldwide. However, it is difficult to estimate the associated expenditure in this area. All education and training has a role ‘marketing’ the supplier country and its technology to foreign students.

Underwater Technology (€1.2bn in 2005, €1.4bn in 2010). This is the manufacture of the high technology equipment associated with hydrographic survey, oceanographic research and all other underwater operations. The common factor that links all parts of the sector is a high electronics content. Underwater technology includes the manufacture of underwater vehicles (ROVs, AUVs), oceanographic instrumentation and deployment systems, sonars and survey systems, underwater navigation systems. This is an important sector for German companies.

Underwater Vehicle Operations (€0.5bn in 2005, €0.5bn in 2010). Activity will grow until 2009 after which there may be some slight flattening off as European oil & gas sector activity falls. Some 500 large ‘work-class’ ROVs are in commercial operation worldwide, the largest user being the offshore oil & gas industry. AUVs have long been the subject of academic and military research but only entered regular commercial operations in 2001 and about four or five units are presently operating.

Media – we regard Media as a part of the Marine Services sector. Although media is not separately valued in this report, the marine information services offered by the media are of considerable importance in aiding dissemination of market and technical knowledge throughout the industry.

Arts & culture – this has two main roles; firstly in raising public awareness of the marine industries and secondly as a contributor to the leisure and tourism sector. Events such as the Kiel festival and similar ones throughout Europe, generate considerable public interest and provide great economic benefit.

Coastal Engineering – No data available on this sector.

Table 2-1: World Marine Sectors – Value (€million) and Growth

<i>€ million</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2005-10</i>	<i>2005-10 growth</i>
Shipping	344368	287748	275466	274653	290885	307929	325826	1762507	13%
Marine Tourism	168189	173739	179487	185440	191606	197995	204614	1132882	18%
Offshore Oil & Gas	91146	88237	93544	97132	98011	99119	99057	575101	12%
Seafood Processing	79563	75544	76083	76666	77294	77969	78644	462199	4%
Marine Equipment	64246	57474	58761	56949	55603	58001	60346	347133	5%
Fishing	55688	50713	50259	49809	49362	48920	48478	297541	-4%
Shipbuilding	37746	32744	33141	30835	28716	29582	30272	185289	-8%
Naval Shipbuilding	28862	27358	28410	29443	30775	32507	34414	182906	26%
Ports	25017	24827	26068	27111	28196	29324	30496	166022	23%
Marine Aquaculture	23876	24831	25824	26857	27931	29049	30166	164657	21%
Yacht & Boatbuilding	12486	12109	13017	13993	15043	16171	17303	87635	43%
Cruise	12090	12091	12909	13671	14363	14976	15501	83511	28%
Research & Development	10629	10346	10757	10803	11010	11404	11624	65944	12%
Marine Services	6840	5742	5497	5481	5805	6145	6502	35172	13%
Marine Renewable Energy	128	514	1365	2327	2857	5586	4704	17353	815%
Security & Control	0	877	1822	3351	4577	2347	2320	15293	164%
Ocean Survey	2013	1925	1964	2022	2082	2144	2209	12345	15%
Education & Training	1537	1514	1546	1600	1655	1722	1790	9827	18%
Underwater Technology	1312	1275	1323	1335	1363	1409	1438	8142	13%
Underwater Vehicle Ops.	479	479	506	523	537	544	545	3135	14%

Table 2-2: Sector Growth Rates by Year

<i>Annual market growth in € compared with previous year</i>						
	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>
Shipping	-16.4%	-4.3%	-0.3%	5.9%	5.9%	5.8%
Marine Tourism	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%
Offshore Oil & Gas	-3.2%	6.0%	3.8%	0.9%	1.1%	-0.1%
Seafood Processing	-5.1%	0.7%	0.8%	0.8%	0.9%	0.9%
Marine Equipment	-10.5%	2.2%	-3.1%	-2.4%	4.3%	4.0%
Fishing	-8.9%	-0.9%	-0.9%	-0.9%	-0.9%	-0.9%
Naval Shipbuilding	-13.3%	1.2%	-7.0%	-6.9%	3.0%	2.3%
Shipbuilding	-5.2%	3.8%	3.6%	4.5%	5.6%	5.9%
Ports	-0.8%	5.0%	4.0%	4.0%	4.0%	4.0%
Marine Aquaculture	4.0%	4.0%	4.0%	4.0%	4.0%	3.8%
Yacht & Boatbuilding	-3.0%	7.5%	7.5%	7.5%	7.5%	7.0%
Cruise	0.0%	6.8%	5.9%	5.1%	4.3%	3.5%
Research & Development	-2.7%	4.0%	0.4%	1.9%	3.6%	1.9%
Marine Services	-16.0%	-4.3%	-0.3%	5.9%	5.9%	5.8%
Marine Renewable Energy	302.5%	165.4%	70.6%	22.7%	95.6%	-15.8%
Security & Control	n/a	107.7%	83.9%	36.6%	-48.7%	-1.2%
Ocean Survey	-4.4%	2.0%	3.0%	3.0%	3.0%	3.0%
Education & Training	-1.5%	2.1%	3.5%	3.4%	4.0%	3.9%
Underwater Technology	-2.8%	3.7%	0.9%	2.1%	3.4%	2.0%
Underwater Vehicles Ops.	0.1%	5.5%	3.4%	2.7%	1.3%	0.2%

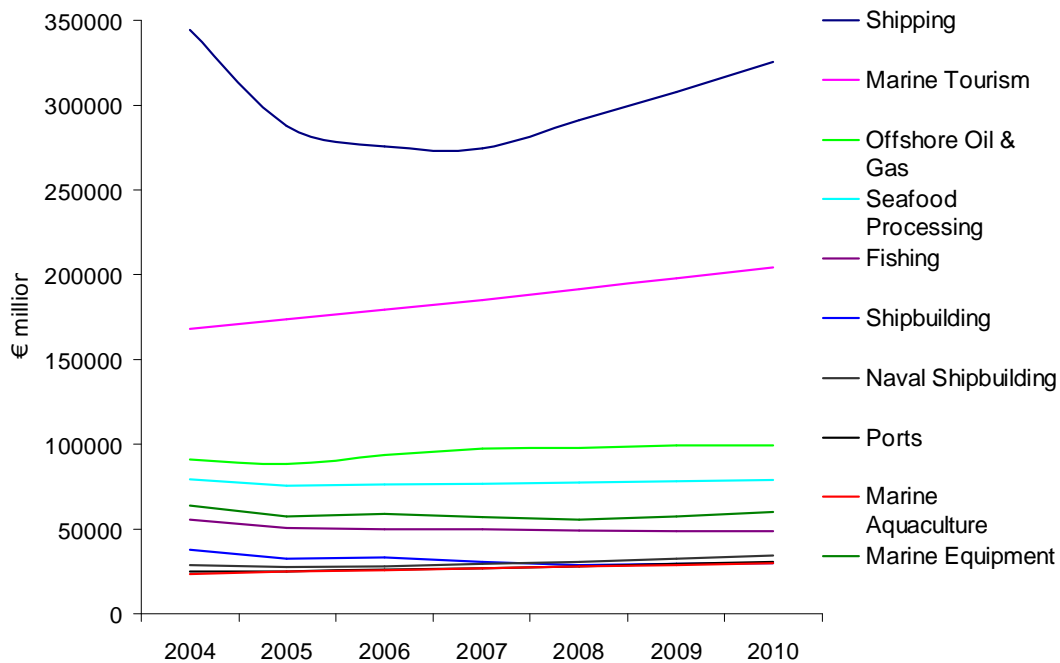


Figure 2-2: Marine Industries – Top 10 Sectors 2004-2010

2.3. Conclusions

The marine sectors together form one of the world's most important industries. Most activity we describe in individual sectors is in support of five key areas:

- Marine Energy – the offshore oil & gas produced is valued at some €700bn
- Shipping & Transportation – €288bn
- Marine Tourism – €174bn
- Fish & Seafood – including processed and non-processed production, €151bn
- Shipbuilding (civil and naval) – €60bn.

About 30% of the world's oil & gas is produced offshore, some 90% of the volume of world trade is carried by the shipping industry, and marine fisheries are a major source of food, particularly for the developing world.

The marine industries are of major economic significance, particularly to coastal communities. Although many of the sectors are large, they often deliver economic benefits that are multiples ranging from 2 to 10 times the values of direct spend we give in this report.

It has been estimated that the European maritime cluster generates employment for almost 1.5 million people. In terms of direct value added, the United Kingdom has the largest maritime cluster, closely followed by Germany and Norway, and the Netherlands and France come next.⁴

⁴ 'The Economic Impact of Maritime Industries in Europe' Policy Research Corporation NV for the European Commission. 2002 (?)

We believe that Germany has some major strengths in world markets. Germany has a strong maritime tradition and has been more successful than many other European countries in maintaining its market share in some areas of technology and in growing its shipping activities.

1. German engineering and technology has a world-class reputation. The country is a world market leader in a diverse range of engineered marine products ranging from ship's engines to high technology sonars.
2. Germany has been particularly successful in developing its commercial initiatives. It is reported that at the end of 2004, German owners controlled 2,560 ships and it is the third largest owner by tonnage. The fleet has doubled since the introduction of the tax five years ago and it has been particularly successful in the container ships sector.
3. Although orders vary from year to year, Germany's shipbuilding industry has a remarkable record of achievement in holding onto its share of tonnage built in Europe.

In common with the rest of Western Europe, Germany's weakness are its high manufacturing costs when compared to the growing economies of China and Eastern Europe. Maintaining this position in future years will demand considerable commercial and technical innovation.

2.4. Recommendations

Three technology areas may offer particular opportunities and could justify additional research:

- Underwater technology – this is a particular area of German expertise. For example, the country is a leading player in the design, development and production of sonars and is a very successful manufacturer of (military) underwater vehicles. However, there is little data available on the size and structure of the world market. We recommend a study is commissioned on the world market for German underwater technology (e.g. the combined value of ROVs, AUVs, sonar, oceanographic instrumentation, etc) and identification of opportunities.
- Offshore renewable energy – this sector shows strong growth prospects particularly as conventional fossil fuel energy prices increase. Germany is a world leader in windpower technology, but as the sector grows in value competition will also grow. There is a case for an ongoing national programme of research and development. However, a major factor is the need for Germany to quickly develop its home market for offshore windpower in order to give German suppliers confidence in the home market prospects.
- Marine Security – is a new and potentially high growth sector. There is little information so far on the available markets and technologies and further market research work is needed in this area.

In more general terms, there is a need to more fully understand the opportunities offered by the very large but complex marine equipment market.

3. LONG-TERM FACTORS

Before developing values for the individual sectors of the marine industry it is necessary to consider the underlying macro-factors and how they are likely to impact in future years. The most significant of these are:

- Economic & political change
- Globalisation and the growth of seaborne trade
- Growth of low cost manufacturing locations
- Demographic change
- Global warming
- Energy supply and demand.

3.1. Economic and Political Change

Over the past 40 years, there is a major event, usually politically driven, every five to seven years that causes severe disruption to global economies and major impact on the marine industries. The most recent of these is the US response to 9/11 'war on terrorism' which may have marked the start of a new type of low-intensity war with occasional flare-ups in different parts of the world.

Underlying much of the instability in the Middle East is the demographic imbalance caused by rapidly growing populations, sometimes well educated, but often with poor employment prospects. Saudi Arabia is a case in point where despite its oil wealth, GDP per head is low.

Regional wars and prolonged domestic or ethnic violence create some of the most pronounced shocks to the world economy, due to the substantial costs faced by the countries or regions involved. Increasingly disputes may hinge on one side using the control of a vital commodity, such as oil, against the other.

The security of energy supply is therefore a significant issue. Most of the world's oil reserves are located in countries with the potential for serious political upheaval in the coming years, such as the Arab states.

In the world today there is a heightened degree of interdependence between countries, which means disruption in one part of the world could have a knock-on effect in unforeseen locations. As well as ties spanning long distances, such as the UK-US relationship, closer to home, the EU community has recently expanded considerably.

EU Policies

In 2004 ten more countries joined the EU, taking the total number of member states from 15 to 25. This enlargement has brought trade and investment opportunities and increases the EU population by 20%. This larger internal market means that firms can expand production and take advantage of economies of scale. The additional members will increase the EU's authority and influence in international trade talks. The potential for existing members to expand into new markets is also great. Although to a great extent the enlargement took place in the 1990s, with European agreements liberalizing trade. The EU's export trade has risen 73% since 1995 and imports by 81%.⁵

Alongside the increased number of member states, other EU measures are likely to affect the marine sector. Key points of current European maritime transport policy are:

- Revision of Community State Aid guidelines – stricter monitoring of state aid and strengthening of the flag-link to continue the benefit from tonnage tax.
- Liberalisation of port services.
- Build on the success of short sea shipping (in 2001 this provided 40% of EU tonne-km) and the 'Motorways of the Sea' programme.

⁵ Dr Fischler, F, Speech, <http://www.europaworld.org/week164/speechfischler13204.htm>, Vienna, February 13 2004 (No values given in speech, only percentages)

- The 'Marco Polo' programme – a second programme is being established from 2007 to shift international road freight to water and rail.
- Competition rules – adoption of a white paper to introduce more competition into the sector.
- Safety – (following the sinking of the 'Prestige') accelerated phasing out of single hull tankers.
- Establishment of the European Maritime Safety Agency and the Future Maritime Safety Package.
- Maritime security – enhancing ship and port security.
- Human issues – directive on the Minimum Standard of Training for Seafarers. Consolidation of all existing maritime labour standards.

However, despite the importance of the marine industries, Europe does not at present have a unified maritime policy and a public consultation on this is being launched.

Security

The continuing effects of 9/11 have increased concerns over maritime security. Maritime transport is vulnerable to terrorist attack. The cruise ship sector has benefited, business for US cruise lines increased as a result of a reluctance of some to holiday using air travel.

Many initiatives and legislation have already been adopted by individual countries and also internationally, most recently with the introduction of the ISPS Code (International Ship and Port Facility Security Code). Such legislation will lead to fundamental changes in the maritime industry. The Code stipulates a number of new regulations that require additional resources, the costs of which will fall upon those the measures are designed to protect. Also, some believe that the Code relies on seafarers for security and the additional workload is making it more difficult to recruit and retain them.

Local Content

It is common for countries demand a certain level of local content in any contracts awarded to foreign companies. For operations in developed countries this is not a great problem as work can be sub-contracted to local companies. However, developing countries present a challenge as they do not often have the established industrial infrastructure to act as sub-contractors.

Achieving local content is becoming a significant problem in the case of large projects such as those undertaken for the offshore oil & gas industry in Brazil, Angola and Nigeria.

3.2. Globalisation & Seaborne Trade

The marine industries are global in their nature and not confined by national borders. The world market is growing, stimulated by increasing consumer demand and cost reductions associated with the globalisation of production. Low-cost manufacturing areas continue to increase in importance and the export of manufactured goods from developing countries doubled between 1981 and 2000. As the western world still accounts for two-thirds of the world's manufactured imports, growth in the developing economies is still dependent on the markets in the developed world.

In the past three decades South East Asia has become the world's leading shipbuilding region. However, the market leaders, Japan and South Korea, are increasingly likely to be threatened by China with its lower costs. China is integrating into the global economy rapidly, since becoming a member of the WTO at the end of 2001.

China's demand for raw materials and energy has recently grown exponentially. For example, whilst European oil consumption has remained relatively constant over the past decade, China's has doubled. In 2004 Chinese steel imports declined but exports doubled – by 2006 China is forecast to be producing 30% of the world's steel.

China's economic development is now considered to be one of the most important stimuli to growth for the tanker, chemical, bulk and container trades. Order books for newbuilds are at record levels and if world trade continues to grow at expected rates, then this extra capacity will eventually be absorbed without any significant long-term fall in capacity utilization. However, there is likely to be a dampening

the currently rising rates for vessels, at least in the short term. The volume of international seaborne trade increased in 2003 by 4.4%, compared with the previous year, to 5,840 million tonnes and tonne-miles by 5.9%. In line with such increases in international trade, ports have recently shown major increases in throughput, especially in container volumes.

Table 3-1: Annual Average Growth Rate (%)

	2000-05	2005-10	2010-15	2015-22
dry bulk	3.0	2.8	1.7	1.5
tanker	1.3	1.7	1.4	1.3
general cargo	3.4	4.2	3.2	2.7
container	5.7	5.3	4.3	3.8

Source: ISL / Global Insight World Trade Service

The strong growth of 2004 is unlikely to be sustained at such high levels. Limits are being experienced in other parts of the transportation infrastructure – the Panama Canal is operating at 93% of capacity. The increasing need for major infrastructure investments may be a factor restraining growth – the Panama Canal needs \$8bn investment.

However, world seaborne trade is predicted to grow substantially over the long term. Container traffic should experience the strongest growth as there is a continuing shift to the use of containers for general cargo. From 576 million tonnes in 2004, (11% of world seaborne trade) container traffic is expected to reach to 1.3 billion tonnes (46%) by 2022.⁶

Other forecasts say there will be another 2 billion tons of cargo in 2025. The OECD region is now economically mature so it is growing quite slowly. As Asia grows and China finds its feet the importance of the ring of economies around the South China Sea will increase. India is on the road to deregulation and is growing fast. And over the next twenty five years the ex-Soviet states may overcome their present difficulties and become a more substantial economic force. Latin America is growing steadily and with each decade will gain critical mass as a centre of trade.⁷

In the case of China, its exports will have doubled between 2000 and 2005. Its container exports are forecast to grow from some 15 million TEU in 2004 to 40 million by 2020.

All such forecasts assume continued availability of cheap energy – a situation we greatly doubt.

Many future technical challenges relate to ship operations – both cost reduction and environmental impact. In the light of the concerns over global terrorism and in some parts of the world piracy, security has become major issue.

3.3. Demographic Change

The population of the developed world is aging, with unprecedented growth in the proportion of the population over the age of 60. This is a result of the demographic transition from high to low fertility and mortality rates. This situation has profound effects on all facets of human life. In the economic area, population ageing will have an impact on economic growth, savings, investment and consumption, labour markets, pensions, taxation and intergenerational transfers.

Developing countries, however, have not achieved such advanced levels of transition so their populations continue to grow. In 2000 the world population was 6.1 billion and growing at 1.4% annually, representing an increase in population of 85 million people per year. Almost all of this growth is concentrated in Asia, Latin America and Africa. China has 21% of the world population and this size is already manifesting itself strongly in terms of soaring consumption and exports.

⁶ Global Insight World Trade Service

⁷ 'The Demand for Sea Transport 2000 to 2025' Clarksons, 2004

Western world engineering capacity is due to decline as more of the population reach retirement age, coupled with a decline in students taking engineering. In emerging markets such as India and China about 40% of students take engineering degrees compared with the US at 4%.⁸

3.4. Low-cost Manufacturing

The western world is ‘exporting’ job opportunities and importing consumer goods. One impact of changing global demographics is a transfer of manufacturing to countries with low-cost skilled workforces of which China and India are prime examples. Over the decade to 2000, the fastest growing exports were ‘high technology goods’ (electronics, etc.) with annual average growth in US\$ terms of 12.3%.⁹ (By comparison, low technology ‘resource-based’ manufacturing grew at an average of 7.6%.)

The fundamental reason for developing countries export growth is low costs. Electronics company Samsung pays workers in the UK £5.61 (€8.15) an hour, in Slovakia £1 (€1.45) and in China £0.5 (€0.73). Other examples include: “The labour content of a tyre in China is around 4%. In the West it is 30%. Even in Korea it is now 18%”.¹⁰

Another factor is low labour productivity due to shorter working hours in some Eurozone countries when compared to the USA. In 1970 the annual number of working hours per capita in the US and the Eurozone countries was about 800, it is now about 950 in the US and less than 700 in the Eurozone.¹¹ In the period 2000-4 the Eurozone achieved annual productivity increases of 0.5-1.0%, the US 3.8-4.0%.¹²

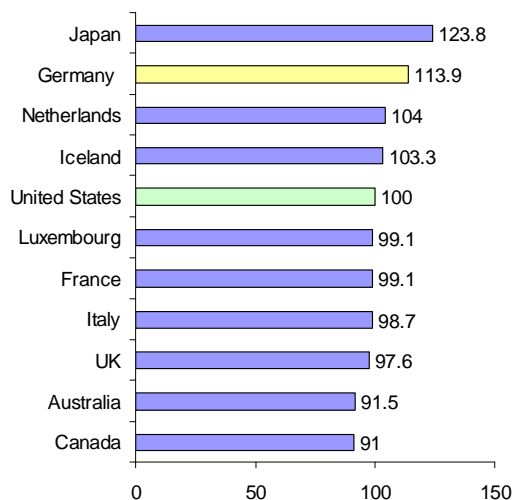


Figure 3-1: Comparative Manufacturing Costs

A study published in 2004 by KPMG compares business costs in 11 industrialised countries (but does not include China). 27 cost components are measured ranging from labour to transport and taxes.

The table shows comparative post-tax costs in each country. The study notes that the most important factor impacting on international competitiveness since 2002 has been the decline in the US\$, with the result it now holds a 19% cost advantage over Germany, up from 1.9% in 2002.¹³

3.5. Global Warming

The United Nations Framework Convention on Climate Change was adopted in 1992. In 1997 many developed countries such as Germany and the UK signed the Kyoto Protocol making a commitment to reducing global emissions legally binding. The effects of climate change, if emissions go unchecked are increases in sea temperature, storm intensity, wave height and sea level as well as possible changes in sea currents, with profound long-term implications for marine life.

In addition to the need to cut emissions, increased demand for energy and a possible decline in oil supply over the next few years could increase the need and commerciality of renewable energy. Renewable energy is already the fastest growing sector of the energy industry. Many suggest that governments need to get more involved with policies to promote the sector, but others feel it should be left to market forces.

⁸ Bill Gates addressing the World Economic Forum. *Financial Times*, p1, 31 Jan 05

⁹ UNIDO database

¹⁰ Sae-Chul Oh, CEO South Korea's Kumho tyres group quoted in the *Financial Times*, 1 March 2005.

¹¹ Paul de Grave, professor of international economics University of Leuven. *Financial Times*, 5 Aug 2004.

¹² *Financial Times*, p3, 16 Jan 2004.

¹³ <http://www.competitivealternatives.com/>

Responses to the effects of climate change include a considerable increase in support for renewable energy. Environmental policies are impacting on sub-sectors ranging from marine propulsion to offshore engineering projects.

3.6. Energy Supply & Demand

Oil & Gas

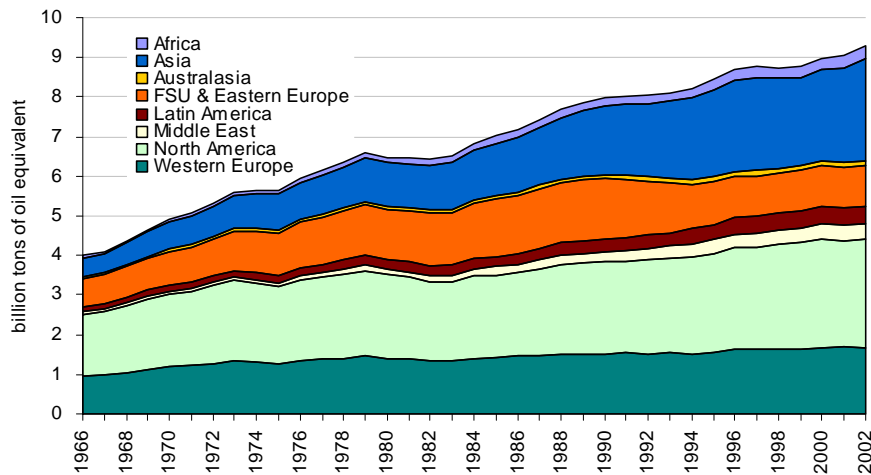


Figure 3-2: World Energy Consumption by Region

Source; BP

World energy consumption has more than doubled over the past four decades, mostly being driven by the developing economies. Increased economic activity demands more energy and some 62% is currently supplied from oil & gas, with about one third of this is produced offshore.

In 2004, oil demand was some 80 million barrels per day (b/d) but the IEA forecasts this demand will grow to 118 million b/d by 2025. Since 1973, European oil demand has grown by only 6%, the USA by 16%, whilst in the developing economies growth has been 202%.

Most governments assume oil supplies are virtually unlimited. However, there are other views. Three fundamentals are now strongly evident: increasing oil demand, reducing reserves and a decline in discovery rates.

For the past 30 years oil prices have been subject to massive fluctuations as a result of political actions ranging from local civil disturbance to outright wars in the Middle East. The results were the tripling of oil prices in 1973 and again in 1979. The reaction of the oil consuming western economies has been to seek oil supplies from other less troubled areas, resulting in the development of whole new oil production provinces such as the North Sea. Although oil demand has continued to grow, from some 58 million barrels per day (bpd) in 1973 to some 80 million bpd in 2004, the proportion shipped from the Middle East has fallen as the Opec countries lost market share to these new non-Opec suppliers.

However, in the North Sea and some other shallow-water offshore areas oil & gas production has passed its peak and will soon be entering a period of terminal decline. Coupled with other factors, the effects of supply restrictions are now evident in prices that exceeded \$53 in late 2004.

Conventional non-Opec oil supplies are being used up at an alarming rate and at present Opec countries are unable to provide much more. Politics permitting, in the short term oil prices could moderate. But longer term, the situation for oil consumers – in other words all of us – is not looking good.

Natural Gas and LNG

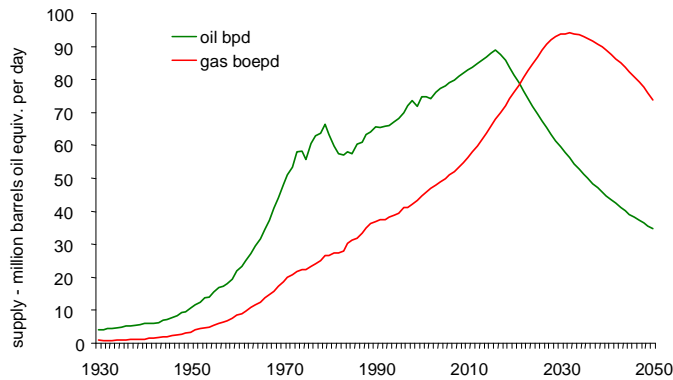


Figure 3-3: Oil & Gas Supply Forecasts

Source: “The World Oil Supply Report”

Growth in demand for natural gas is outstripping that of oil. Gas reserves are considerable possibly amounting to at least 20 years more than oil. However, these major reserves are far removed from markets and depletion of reserves in countries such as the UK and the USA means that activity is focused on long-distance subsea pipelines.

Despite this, much gas is economically stranded and at present liquefaction offers the only real solution. Investment in LNG plants, LNG tankers and offshore import terminals is set to boom. Analysis for ‘The World LNG & GTL Report’¹⁴ indicates a 40% growth in spend, which over the next few years will start to exceed \$10bn per annum. However, in the longer term the demand for LNG is set to grow much more.

Another factor that could boost the use of gas is a growth in its conversion to liquid fuels – Gas to Liquids. GTL, regarded as a high cost process, has been made increasingly viable by high oil prices and the abundance of gas supplies, resulting in major investments in the Middle East.

Oil Prices

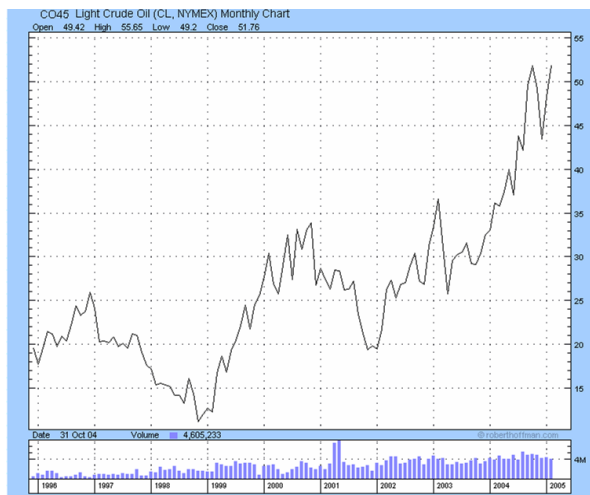


Figure 3-4: Oil Prices 1996-2005

Source: futures.tradingcharts.com

As Opec’s share grows it will increasingly be in a position to more effectively control global supply and a sustained rise in oil prices will therefore occur. The balancing act between getting top dollar for its oil and damaging customer economies by prices that are too high will be difficult to get right and requires Opec members to bring onstream much more capacity to satisfy demand – the big question is, can they do this?

It is generally accepted that the major Opec economies need \$30 oil to balance their economies, a figure inflated by recent falls in the value of the US dollar. In short, it is very unlikely that from now on we will see a sustained period with prices much below this \$30 threshold. On 9 March 2005 oil prices reached \$55.65.

¹⁴ ‘The World Gas Supply Report’, Douglas-Westwood Limited

Peak oil

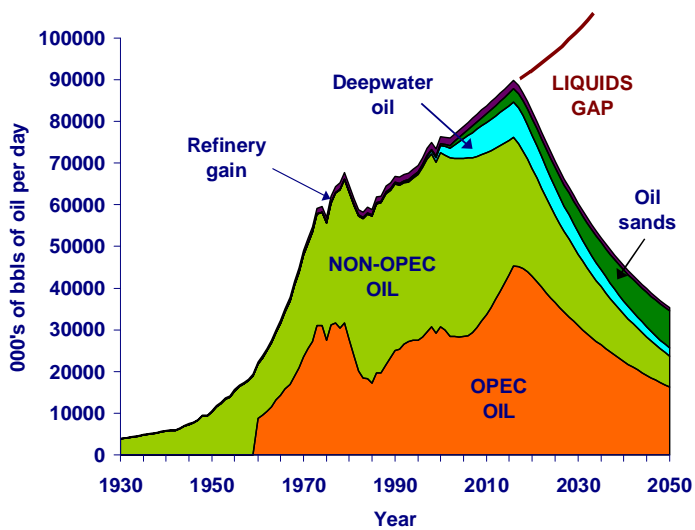


Figure 3-5: Global Oil Supply to Peak?

Source: "The World Oil Supply Report"

Analysis for 'The World Oil Supply Report' shows that it is increasingly likely that oil supplies will peak, possibly within a decade. In short, the world is likely to run out of (cheap) oil. It is becoming increasingly recognised that the situation is not if this will happen but when and how the energy supply industry will react.

The fundamental conclusions remain that the world's known and estimated yet-to-find oil reserves and resources cannot satisfy even the present level of production beyond 2020. Just 1% growth in demand is such that a production peak occurs as early as 2016 at some 85 million barrels per day. Increased demand gives a higher peak but earlier.

Although the response will be complex, this will ultimately result in a sustained major increase in oil prices and a huge demand for other energy sources.

Other Energy Sources

We expect a strong growth in demand for natural gas, particularly LNG. Some power generation capacity will have to switch back to environmentally unfashionable coal, possibly sourced from countries such as Australia leading to increased demand for coal carriers. However, ultimately it is likely that nuclear power will have to be resurrected.

Marine renewable energy has prospects for strong growth, particularly offshore windpower as onshore sites are used up. Analysis of prospects in the 'The World Offshore Wind Database' suggests a capital spend of nearly \$10bn over the next five years. The immediate growth market where activity is already underway is the UK where we forecast 499 turbines will be installed offshore. This will be followed by Germany with 558 turbines.

Wave and tidal power is an embryonic industry but with good long-term prospects. 'The World Wave and Tidal Database' is forecasting the cost of annual installation to reach \$150 million by 2006.

Energy – a Long Term View

There is growing support for the view that oil prices could increase considerably in the early years of the next decade. Unmanaged, this could have a significant impact on global GDP and world trade.

High oil demand mainly emanating from China has resulted in a surge of orders for tankers. This new capacity will take some time to be fully absorbed by the market and may result in some medium-term oversupply. However, we then expect long-term tanker-building growth trend to resume. The problem could then become the limits of oil supplies which we believe may occur around 2015. This is likely to reinforce the present strong growth in demand for LNG carriers, increase development of demand for LPG carriers and drive a long-term growth in the coal freighters market.

In the long-term fossil-fuel generation costs can only increase and a likely effect is that the present emphasis on developing renewable energy for environmental reasons will be overtaken by a drive to ensure security of supplies.

Any restriction of oil supplies will increase pressures for more investment in renewable energy. The comparative costs of generating energy from renewable sources will reduce as oil prices rise. Investment in renewable energy should be key factor in national strategy. In light of future shortfalls, investment in energy is a win-win situation.

4. SHIPPING

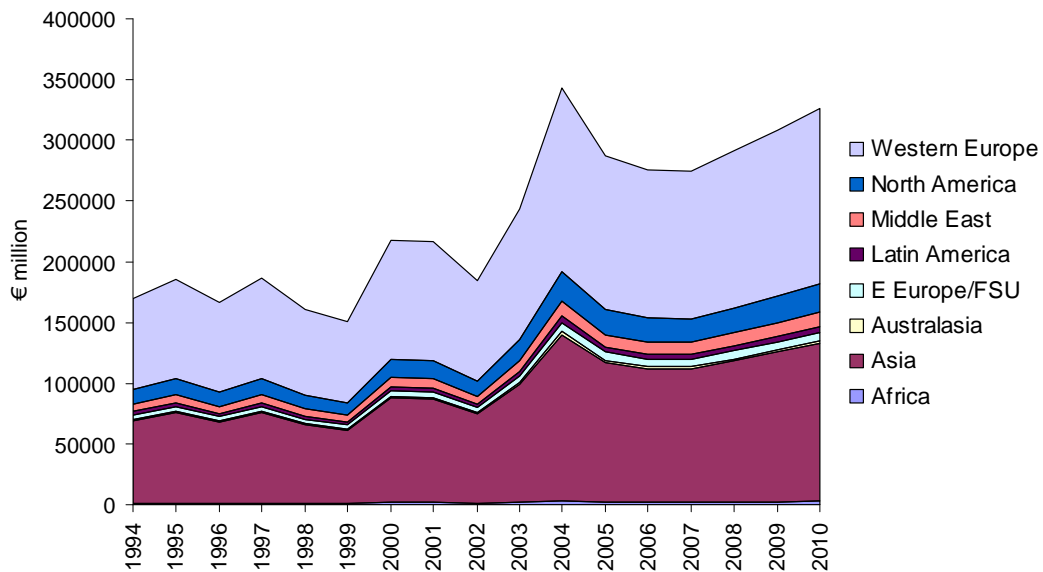


Figure 4-1: Shipping – World Market

Source: Douglas-Westwood

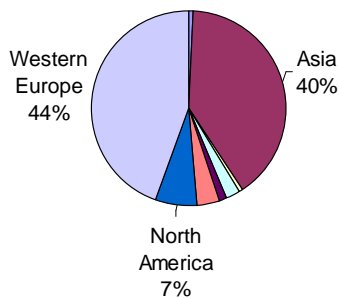


Figure 4-2: Shipping – Forecast World Regions Segmentation 2005

Source: Douglas-Westwood

The market is dominated by European and SE Asian shipping companies.

Shipping	2005	2010
World €M	287748	325826
Europe €M	127646	144537

Definition – UNCTAD estimate of the percentage of total seaborne trade that constitutes the total cost of shipping.

Methodology – We segment the UNCTAD estimate by the nationality of ‘beneficial owner’ of world tonnage and have checked against actual values where known, (such as in the case of Denmark). Forecasts are based on our projections of total seaborne world trade in tonne-miles. We then applied our view of overall shipping rates to this by projecting the ClarkSea shipping rates index. Shipping rates are the major factor impacting on the future value of the market. Here the key driver is vessel availability and we expect this to increase somewhat as new tonnage currently on order enters the market and China’s economic activity moderates.

4.1. Overview

There are more than 90,000 ships registered and perhaps 50,000 merchant ships trading internationally. The world fleet is registered in over 150 nations, and manned by over a million seafarers of virtually every nationality.¹⁵

We estimate merchant shipping was a €243bn industry in 2003. A rise in world trade of 16% mainly driven by the Chinese economic boom has driven up shipping rates and means the market is likely to have grown to €342bn in 2004 – the best year for 30 years. Although seaborne trade will continue to increase, we forecast falling freight rates as more shipping capacity enters the market resulting in an average of €287bn from 2005-09.

¹⁵ <http://www.marisec.org/shippingfacts/keyfacts.htm>

The main driver of the shipping industry is the tonnage of seaborne trade (import & export), the volume and geographic distribution of which changes as a function of nations' GDP. Seaborne transport is estimated to be responsible for up to 90% of world trade and in the case of some countries such as Brazil and Peru (95%).

The volume of trade impacts on availability of vessels and hence vessel charter rates. In effect, a relatively small increase in demand can result in a large increase in shipping rates (and vice versa).

The result is considerable variations in the values of the shipping sector from year to year.

Over the last four decades seaborne trade has nearly quadrupled and as shown below the volume of shipping business continues to rise. The OECD estimates a world trade growth at 7.8% for 2004 and 9.1% for 2005.

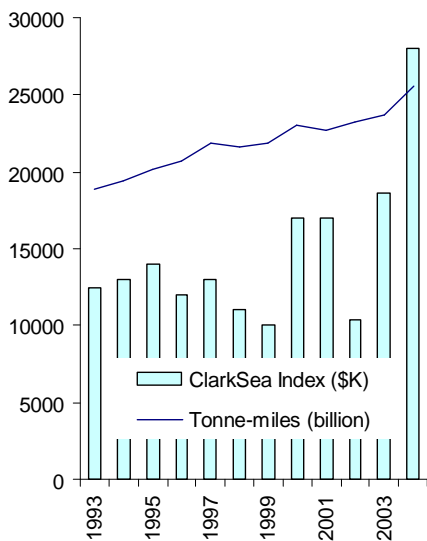


Figure 4-3: Tonne-miles and Charter Rates

Source: Fernleys & Clarksons

The ClarkSea index in 2004 shipping shows rates averaging \$28,000 – compared with previous ten-year average of \$13,800. The chart also shows the increasing instability of rates.

Shipping has traditionally been a boom-bust industry where any major upturn is eventually undermined by over-investment in new vessels. Drewry Shipping has stated that the 14% increase in shipping capacity in 2006 is likely to outstrip demand in that year. The Korea Marine Institute expects tanker supply to outstrip demand in 2005. Our own view is of a gradual slowing of shipping sector growth and a return to more normal long-term trends by 2007.

The CFO of Germany's KG market leader MPC Capital will not be placing newbuilding orders in 2005, as they "do not see the boom in charter rates persisting much longer. By the end of 2006 or the beginning of 2007 the tonnage available to the market will be enormous. However, there are factors that may keep rates high such as port congestion, a further boom in China and India".¹⁶

In the container sector, trade growth is forecast at 10.5% in 2005, slowing slightly to 9.7% in 2006. However, on the supply side, the container vessel fleet is expected to increase by 9.8% in 2005 and 12.6% in 2006 and 8.8% in 2007. So overall, a 'soft landing' is projected for container shipping rates.¹⁷

4.2. European Market

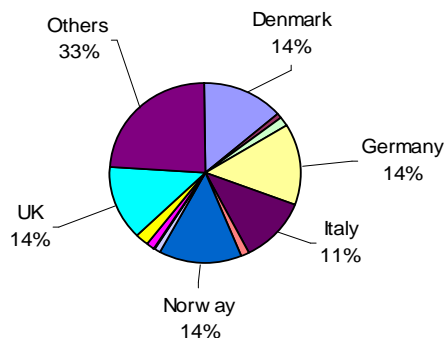


Figure 4-4: Shipping – European Segmentation 2005

The shipping industry is important to Denmark, Germany, Italy, Norway and the UK. (Others in the chart includes Greece which owns 16% of the world's gross merchant tonnage.)

¹⁶ *Lloyd's List* p3, 1 Mar 05

¹⁷ Clarkson's reported in *Lloyds List*, p4 2 Jan 05

The European Union is very dependant on maritime transport. Official statistics state that 70% of external trade (the European Community Shipowners Association say 90%) and 20% of internal trade in terms of volume is made by sea. A large part of the increase over the years can be attributed to the import of oil and oil-based products.

Shipping divides into two areas; deep-sea transport (shipping on long sea routes) and short-sea shipping (between national or European ports).

It has been stated that there were 14,000 enterprises active in the EU in 2001 generating €13.4bn of added value and employing 155,000 persons. (Includes both deep-sea and coastal transport.) The value added at 232% of personnel costs compares with an average (for non-financial services) of 148%.

The sector is characterised by ‘flags of convenience’ or ‘open registries’ whereby vessels controlled by owners in one country are registered in another that offers more attractive terms for taxation and legislation.

For example, at the time of writing, Irish Ferries was in process of reflagging a vessel to the Bahamas. Norway has lost business as an international shipping industry centre due to continuing tax wrangling between owners and government.

In an effort to counteract the impact of this 11 European countries have adopted a favourable taxation programme based on tonnage operated rather than profits and this ‘tonnage tax’ has resulted in more owners registering ships with European countries.

Table 4-1: Top-10 Controlled & Registered Fleets

<i>DWT (M)</i>	<i>2000</i>	<i>2004</i>	<i>growth</i>
Greece	135.1	161.4	19%
Japan	96.3	114.2	19%
Germany	30.9	51.5	67%
China	39.2	49.1	25%
Norway	54.1	43.8	-19%
US	44.5	40.6	-9%
Hong Kong	36.7	37.9	3%
Korea	35.5	26.2	-26%
Taiwan	19.9	23.7	19%
Singapore	19	23.3	23%
Sub-total	501.3	571.7	14%
other	257.2	283.2	10%
World Total	758.5	854.9	13%
Europe	341.2	375.2	10%
Asia & Oceania	309.9	362.6	17%
America	62.9	58.8	-7%
Africa	6	5.1	-15%
Unknown	38.7	53.3	38%

Source: ISL, ships =>1,000 dwt

The above table of the top 10 ship-owning countries shows the success of Germany which has grown its controlled and registered DWT by 67% in four years to take third place. By comparison Norway has failed to maintain a competitive position, falling to fifth place.

The EEA (European Economic Area) registered fleet increased to about 28% of the world fleet in 2003, a growth of 50% compared to the previous year. Clearly the fleets of the new EU countries contributed to

this but even without these there was growth of almost 5%.¹⁸ However, arguably the more significant figure is that the EU *controlled* fleet now represents 44% of the world merchant fleet.

Greece is the biggest shipping operator both in Europe and worldwide, but secrecy regarding its shipping turnover is legendary. However, the Bank of Greece expects turnover of €10.9bn for the first 10 months of 2004. We believe this figure grossly undervalues Greek market share of 16% of world gross tonnage (as Denmark generates the same turnover with 2.2%).

Greek shipowners control some 161 million DWT, a value that has increased at 4.6% per annum since 2000.

Denmark, which has a supportive tax regime has seen its flagged tonnage grow by 40% over the last decade. Danish shipping revenues were €15bn in 2003

Finland has few newbuildings registered under its flag, with the average age of the fleet at nearly 20 years, almost entirely manned by Finnish seafarers due to a strong union opposing foreign employees. Finland's foreign trade shipments (import and exports) were over 93 million tonnes in 2003.

The **French** fleet consists of 207 ships and has an average age of less than eight years, representing 4.6 million GT and 6.2 million DWT.

Germany's fleet in 2003 was expanding with 118 newbuildings, making it the fourth largest in the world, with its largest component being its 919 container ships. ISL report that German shipowners increased their controlled tonnage by an annual average of 13.7% to control 51 million dwt, but only 7 million was attributable to the German registered tonnage. At the end of 2004, German owners controlled 2,560 ships. The fleet has doubled since the introduction of the tax five years ago. (It is reported that "in exchange for considerable subsidies" a further 110 vessels will be bought into the German flagged fleet by end 2005, bringing the total to 400.)¹⁹

Ireland's tax tonnage regime and low corporate tax rate has been of interest to national and European shipowners and the country has shown good development. Older tonnage is being replaced by newer secondhand ships and there were 47 vessels entered with the Irish Chamber in 2003 – an increase of 68% since 1999. The IMDO estimate that since 2000 employment in international shipping has increased by an average annual rate of 5.6%.²⁰ These increases are mainly attributed to the introduction of a tonnage tax regime. The Marine Institute believes that shipping was a €1.6bn sector in 2003.

Italy's fleet numbers 1,407 vessels of which 676 are over 1,000 GT. There has been a 4% increase in tonnage on 2002, but a 2% decrease in vessel numbers. There are a large number of newbuilds within the fleet and growing registration in the Italian International Register. 134 newbuilds were ordered during the 2000-2003 period. In 2003 shipping (the transport of cargo and passengers) totalled €12.2bn and employed 26,800 people and the maritime sector as a whole produced €26.3bn.

The Netherlands witnessed a slight decrease in the numbers of ships registering in the country from the end of 2003 (786), compared to 2002 (810). The first time since 1996 numbers have not increased, perhaps signalling that newbuilds are being registered elsewhere or existing ships re-registered outside the country. The shipping industry is worth €12.6bn and employs 190,000.

Norway did not benefit from the steep rise in freight rates experienced internationally in 2003. The fleet also shrank by 48 ships, a similar decrease to 2002, leaving 953. The Norwegian Tonnage Tax System is not competitive with some EU countries, but there are plans to align it with the EU and a commission was set up in late 2004.

¹⁸ 'Current International Shipping Market Trends' European Commission. OECD Workshop on Maritime Transport. Paris, November 2004.

¹⁹ *Lloyds List* p3, 26 Jan 2005

²⁰ Duffy, C, *Ireland – growing international shipping centre*. Shipping Finance Annual 2004/5

Portugal's fleet continues to decline, due to lack of development in the national shipping policy. Although a commission for a cruise ferry passenger liner was recently awarded and three bulk carriers were purchased in 2003.

Spain had a more positive year, with the Spanish controlled merchant fleet increasing 8.3% in GT in 2003 with 40 newbuildings since 2000. Maritime trade increased by 1.4% from 2002, to 290 million tonnes.

In 2003, **Swedish** shipping consisted of 571 ships totalling 10.8 million DWT, a slight increase on 2002. 29 new vessels totalling 1.1 million DWT were delivered to Swedish shipowners during 2003. During 2004 12 new vessels were to be delivered.

Since January 2000, the **UK**-owned trading fleet has now more than doubled, and the tonnage under the UK flag has increased by over 250%. During 2003 UK shipowners purchased vessels (new and second hand) to the value of €898 million.²¹ At the end of 2003, the UK managed nearly 6% of the world's DWT which suggests a turnover of €14.6bn. At end 2004, 71 companies operated 758 ships.

4.3. China

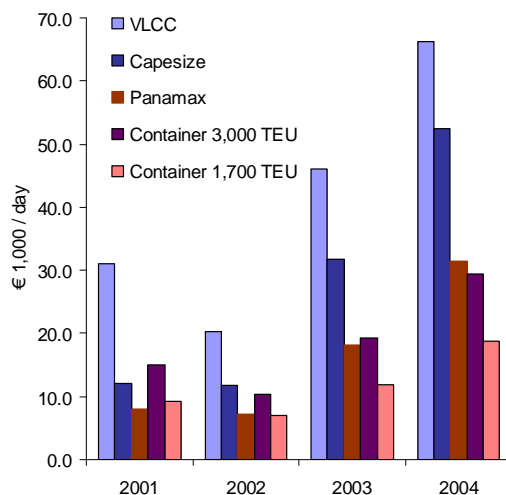


Figure 4-5: Shipping Rates 2001-4

Source: Danish Shipping Association / R.S. Platou

In 2004, rates for many types of shipping were double the averages achieved during the 1999-2003 period and in October some VLCC spot rates reached five times the long-term average.

Shipowners have responded by placing orders and the waiting time for new vessel deliveries reached three years.

Chinese economic growth is the main reason for the remarkable increase in shipping rates and industry profit. In 2003, China's imports expanded by 40% in nominal dollar terms while its exports grew by 35%.

China is in process of becoming the leading global manufacturing base – 'the workshop of the world' (a position once claimed by the UK). Much is driven by low wage rates, often 90% below European levels. Since the late 1970s it has managed to double its GDP every ten years and this is likely to continue for the foreseeable future. However, the recent economic boom could return to its long-term trend with 8% forecast in 2005 compared with an estimated 9.3% in 2004.²² (It should be noted that unofficial estimates have put China's GDP growth at 11% in 2004.)

The growth rate of capital asset investment is expected to be 27% in 2004, (a drop of 15% from the first quarter) and 24% in 2005.

The Chinese government has stated that cooling the economy will be a priority in 2005 and rising interest rates and government-imposed lending curbs are reported to be initiated.

Economic activity has exceeded long-term rates as large amounts are imported to both feed manufacturing and infrastructure developments. The overall result is an unprecedented increase in two-way traffic – import of bulk commodities and export of containers of manufactured goods.

²¹ *Transport Statistics Report 2003*. UK DoT. (published Oct 2004)

²² Survey by the China National Bureau of Statistics reported in *China Daily* 20 December 2004.

Further Chinese growth is also likely as the European global quota system on textiles and clothing is lifted. Ultimately there must be a limit as high growth rates become harder to maintain. For example – China already has 80% share of US imports of toys and footwear.

4.4. World Market

It is difficult to quantify the value of volume of world seaborne trade in monetary terms, as figures for trade estimates are traditionally in terms of tonnes or tonne-miles, and are therefore not comparable with monetary-based statistics for the value of the world economy.

However, the United Nations Conference on Trade and Development (UNCTAD) estimates that the operation of merchant ships contributes about US\$380bn (€292bn) in freight rates within the global economy, equivalent to about 5% of total world trade.²³

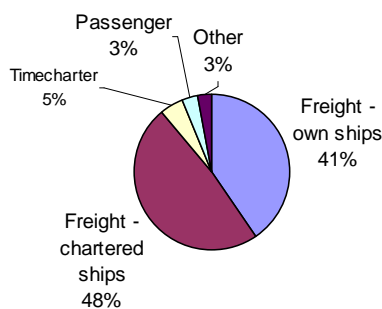


Figure 4-6: Danish Shipowners Earnings 2003

Source: Danish Shipping - Figures²⁴

In order to check the above we have analysed earnings of some major ship owners. As an example, Danish shipping has earnings of some €15bn of which some €5.3bn comes from its own ships. Danish ships form about 2% of the merchant fleet by gross tonnage. If other owners have similar earnings then total world earnings of €243bn are suggested and this is the figure we use.

Table 4-2: Top 25 Shipowners – Tonnage

Country	GT 1,000	GT%				
1 Greece	90590	16.0%	14 Italy	10302	1.8%	
2 Japan	76423	13.5%	15 Malaysia	7211	1.3%	
3 Germany	36314	6.4%	16 India	7079	1.2%	
4 Norway	35169	6.2%	17 Saudi	6655	1.2%	
5 USA	31396	5.5%	18 Switzerland	6527	1.2%	
6 China	29884	5.3%	19 Turkey	5573	1.0%	
7 Hong Kong	17502	3.1%	20 Sweden	5402	1.0%	
8 S Korea	16665	2.9%	21 Iran	4958	0.9%	
9 Taiwan	15291	2.7%	22 Canada	4407	0.8%	
10 UK	14552	2.6%	23 France	4281	0.8%	
11 Singapore	14165	2.5%	24 Netherlands	3969	0.7%	
12 Denmark	12347	2.2%	25 Philippines	3712	0.7%	
13 Russia	10621	1.9%	ROW	95411	16.8%	
			Total world	566406	100.0%	

There is no simple way of precisely apportioning earnings from shipping to regions and countries. The complication is that a ship may be operating under the flag of country A, owned by a company in country B, chartered by a company in country C and trading between countries D and E. The result is that parts of the associated business will accrue to A, B, C, D and E.

²³ *Shipping Facts* <http://www.marisec.org/shippingfacts/worldtradevolume.htm>

²⁴ 'Danish Shipping – Figures' Danish Shipowners Association, 2004

5. MARINE SERVICES

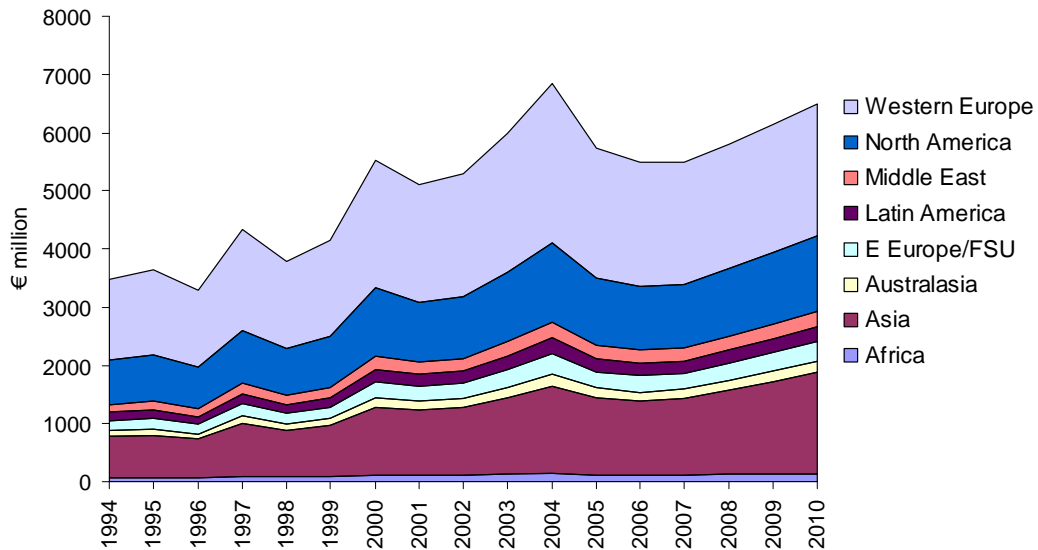


Figure 5-1: Marine Services – World Market

Source: Douglas-Westwood

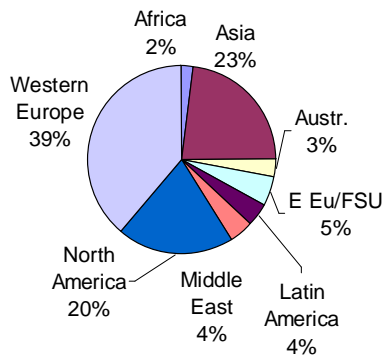


Figure 5-2: Marine Services – World Regions Segmentation 2005

Source: Douglas-Westwood

The market for marine services shows a long-term growth trend. Europe is the leading player, mainly due to the historic dominance of London.

Marine Services	2005	2010
World €M	5742	6502
Europe €M	2239	2276

Definition – Professional services to the shipping sector, excluding shipowners and operators revenues.

Methodology – There is no definitive information on the value of the marine services market worldwide. We therefore take the known value of the London business and scale this up to the world market based on regional shares of shipping activity. Forecasts are then based on our views of growth in the shipping business shown earlier.

5.1. Overview

Marine Services is a long-term growth sector modulated by fluctuations in vessel charter rates. London is the world’s leading centre, but its position is increasingly under threat from SE Asia (particularly Singapore and increasingly Shanghai) due to the high cost of doing business in Europe compared to SE Asia, together with the growth of that region as a major user of shipping.

We estimate that London and Western Europe together accounts for 38% of the world market and Asia 24%.

Due to the complex nature of marine services operations, the figures given are revenues rather than total sales which would be much greater.

“Maritime commerce” is perhaps a better description of this sector that ranges from ship operations, broking and insurance to specialist publications.

Marine services are of major strategic importance as a successful centre tends to cluster decision makers for many associated marine activities.

5.2. European Market

Usually clustered around a specific city, the marine services sector is comprised of many activities. Detailed analysis of marine services clusters are rare and the figure above, drawn from a recent report, depicts London's activities.²⁵

Significant marine services clusters exist in the other major European shipping countries: Germany, for example, is noted for its shipping finance activities, but we have not been able to obtain figures for revenues.

The London model is not directly transposable onto other marine services in other cities, but clearly serves to depict the very wide range of participants. Of particular significance is the interaction with the London financial services community.

One difference to other marine services clusters is the presence of major international organisations such as the IMO in London which serve to act as a point of attraction for a wide range of other official bodies. Also of significance is the presence of the Lloyd's insurance market and the Baltic Exchange.

Table 5-1: Companies in London's Marine Services Cluster

Category	Number of Companies
Ship Agency and Forwarding	336
Shipowners, Operators & Managers	206
Marine Insurance	193
Shipbrokers	143
Maritime Organisations / Associations	105
Maritime Legal Services	101
Consultants & Surveyors	98
Ship Finance & Related Services	62
Charterers	42
ICT Services	35
P&I Insurance	26
Maritime Education and Training	12
Marine Personnel	9
Classification Society	8
Media and Publishing	6
Total	1,382

Net overseas earnings (2002) from marine services in the city are estimated at £1.1bn (€1.7bn), to which earnings from overseas shipping adds a further £1.1bn, giving a total of £2.2bn (€3.4bn). (In this report we treat shipping as a separate activity.)

Total sales are considerably greater. For example, the shipping sector comprised of owners, agencies, brokers & consultants stated sales of £9.4bn (€14.4bn).

In addition to the numbers above, a further 375 have a trading office in London. The report notes that it is difficult to determine how big or important the London cluster is, but it is certainly the largest in the world.

The table should not be seen as representative of the situation in other clusters, such as Hamburg's. In addition, many of the categories are part of the shipping sector's expenditure rather than services. This argument could also be applied to shipping finance.

The supply of marine services is a fundamental need of the world's shipping, shipbuilding and to a lesser extent, most other marine sectors. Shipping activity remains the key driver, therefore demand will grow in line with the shipping sector.

The main potential for change is in where the market for marine services will be supplied from in light of the growth of the Asian market (mainly China) and the strength of Singapore as a major financial sector.

²⁵ *The Future of London's Maritime Services Cluster*. 2004. Corporation of London.

6. PORTS

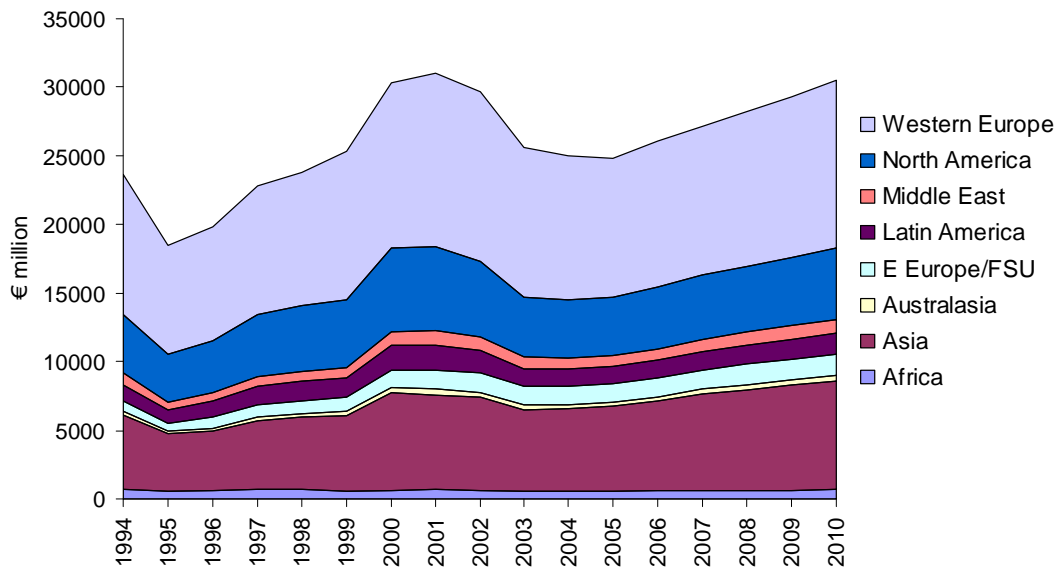


Figure 6-1: Ports – World Market

Source: Douglas-Westwood

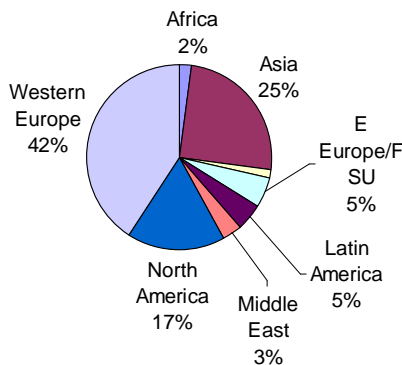


Figure 6-2: Ports – World Regions Segmentation 2005

The ports sector has been growing as a function of increased shipping activity and the move towards containerisation. We expect growth to continue for the foreseeable future. Europe and Asia are the major regions, followed by N America.

Ports	2005	2010
World €M	24827	30496
Europe €M	10151	12165

Definition – Port revenues based on average prices per tonne of cargo handled.

Methodology – We have taken figures for tonnages handled by major ports and port operators, determined average cost per tonne by considering their revenues and applied this to total cargo volumes. (The total value was then compared with the Datamonitor ports report.) Regional segmentation is per the UNCTAD ‘Review of Maritime Transport 2003’. European business was segmented based on the Eurostat Yearbook 2004 for sea transportation of goods. Forecasts are based on the views we developed for growth in the shipping market.

6.1. Overview

The Ports & Terminals Guide lists 8,336 ports and terminals worldwide. Perhaps some 1,600 or so of these are significant ports. In 2002, the top 50 ports handled 5.8 billion tonnes of cargo. In 2003 vessel calls at world ports totalled 576,906.²⁶

Ports are a major benefactor from the strong growth in economic activity in China and, to a lesser extent, India. Rotterdam increased its tonnage by 8% in 2004 and Amsterdam by 13%.

European ports container traffic showed a 10% increase to 60 million TEU (twenty foot equivalent units) in 2003 and it appears that this will be exceeded in 2004. Initial figures from Rotterdam shows a 16%

²⁶ ‘Vessel Calls at US Ports 2003’, US Department of Transportation, Marine Administration Department

surge in container traffic to 8.3 million TEU in 2004 and Hamburg achieved its fifth year of double digit growth.

However, container shipping capacity is growing faster than capacity of many ports to receive them. Concerns have been expressed as to whether the European container terminals and their hinterland connections can adequately adjust to the continuing sharp increases in container volumes in a timely manner. It is reported that in continental Europe port congestion is leading to cargo being shifted back from sea to road contrary to general ambitions. US ports are also experiencing severe congestion.

The result is a very large investment in expanding port capacity worldwide. For example, Shanghai is spending \$10bn in building what it expects to be the world's largest container port. Kuwait is to build a \$1.2bn container port becoming operational in stages from 2008. Spain has announced a plan to spend €23bn on the maritime and ports sectors over the 15 years to 2020. The proposal particularly aims to boost short-sea shipping. New York's capital improvements in 2005 total \$1.7bn.

6.2. Container Operations

The great majority of ports are in public ownership and as a result some suffer from low productivity (particularly in the US). However, capital investment requirements are resulting in privatisation or 'liberalisation' programmes in a number of countries.

	<i>TEU (M)</i>	<i>% share</i>
HPH	41.50	13.3%
PSA	28.70	9.5%
APM	21.40	6.2%
P&O Ports	16.00	4.6%
Eurogate	10.80	3.5%
DPA/DPI group	9.55	3.0%
Cosco	7.40	2.3%
Evergreen	6.70	2.1%
sub-total	142.05	44.5%
world total	319.61	100%

Table 6-1: Top Eight Operators by TEU

Source: Drewry Shipping / Lloyd's List

The ports that are in private ownership are often focused on container handling. Drewry's database records almost 1,500 facilities worldwide. In 2003, the top eight global operating companies handled 142 million TEU, 44% of all containers shipped through ports. The revenues are available for two of these (HPA and P&O Ports) which are responsible for 18% and total €3.8bn. Scaling up suggests the container sector of the dry-cargo ports world market is €22.7bn.

There is significant international merger & acquisition activity – most recently sale of Dubai Ports International, the Hong Kong Port operator for \$1.23bn.

The sector is divided into:

- Global Stevedores – whose primary function is port operations.
- Global Carriers – where terminals are used to support container liner services.
- Hybrids – originally carriers, but increasingly operating their terminals as stand-alone business units.

The integration of shipping, terminal operations and road transportation services means the total value of the container sector greatly exceeds the port operations element.

Globally, the trend continues to move away from traditional bulk and break-bulk (non-containerised) shipping, into unitised cargoes (containerised and roll-on/roll-off) traffic. Worldwide seaborne dry cargo traffic has doubled from 1.8 billion tonnes in 1980 to a forecast 3.6 billion tonnes in 2004, according to Drewry's statistics. The 2003 total was 3.4 billion tonnes and the figure is expected to rise to 3.78 billion in 2004. (These figures include bulk, break-bulk, ro-ro, semi-bulk and containers, but not liquid bulks.)

In 1980 containers represented 6.3% of world traffic. By last year they accounted for 23.8% and this is expected to rise to 26.6% – 386 million TEU (twenty-foot equivalent units) – in 2004. By 2010 container port throughput should reach 432 million TEU. This represents total world container port throughput, including trans-shipment, when hub ports are used to switch containers from one ship to another.

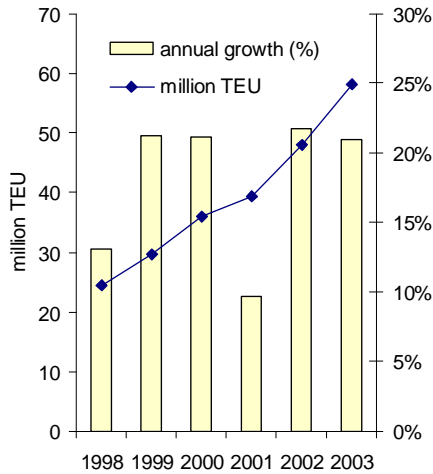


Figure 6-3: Chinese Port Container Throughput

Source: source: Drewry Shipping / Lloyd's List

World container trade has been growing at an average annual rate of 9.3%, with volumes rising from 37.1 million TEU in 1993 to almost 91 million TEU last year. This is expected to reach 154 million TEU by 2010, with the main catalyst for growth coming from China.²⁷

6.3. World Market

Despite the considerable numbers of ports worldwide, the majority of traffic, 5,700 billion tonnes, flows through the top 50 ports. A practical problem in assessing the market is that most ports do not issue annual reports that show total sales revenues, but only show tonnage.²⁸

Annual reports of some of the largest suggest rates per tonne of between €1.12 to €1.67, whereas the smaller can be €2.82 to €3.78. Using these prices suggests a total turnover for the world ports sector of €26.5bn in 2003. Analysis of projections of global trade forecasts suggests the sector will grow to €30bn by 2010. It should be noted that these values exclude other elements of the value chain, also privately-owned tanker terminals and may not fully cover passenger operations.

The sector is of particular importance due the generation of considerable economic activity which is a multiple of port revenues.

In the case of Rotterdam, in 2003 5,741 persons were associated with cargo handling, but the total direct port-related employment was 44,384 and in addition another 14,391 were in port 'industries' such as oil refining, shipbuilding & repair, etc. In addition to the 58,739 in 'direct port-related employment', it is claimed that the port generates indirect employment to 250,000 people.

6.4. European Market

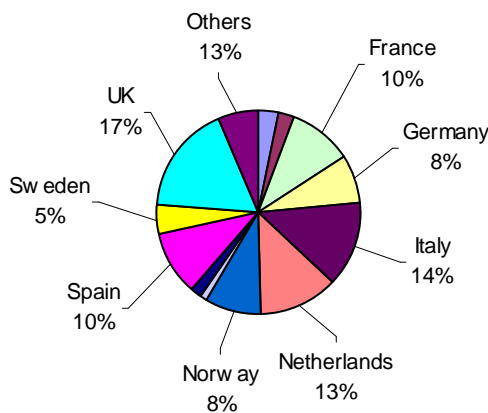


Figure 6-4: European Ports Sector Segmentation 2005

Port activity is distributed across all European coastal countries. Rotterdam, as Europe's largest port is responsible for the shipment of goods to and from several European countries.

²⁷ 'Lifeblood of the Global Economy' Times Online quoting from Drewry Shipping Consultants 7 Sept 2004

²⁸ e.g. The US Public Port Finance Survey relies on voluntary responses and shows net income and tonnage.

In 2002, Europe had 985 ports of which 285 handled over one million tonnes of traffic.²⁹ On average they handle 3.5 billion tonnes of cargo per year and 350 million passengers – the equivalent of 70% of the entire European population.

In Europe the port liberalisation programme started many years ago with the result that EU ports have been stated to be the cheapest in the world. The European Transport Workers Federation claim costs for container handling in Europe averages \$100 (€77) against \$200 (€144) for the US and \$300 (€231) for Japan.

²⁹ Eurostat

7. MARINE TOURISM

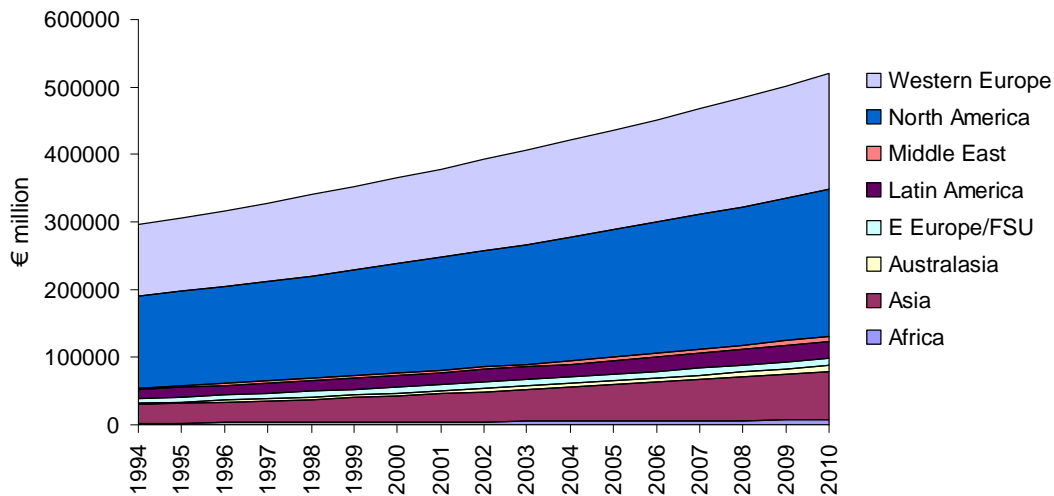


Figure 7-1: Marine Tourism – World Market

Source: Douglas-Westwood

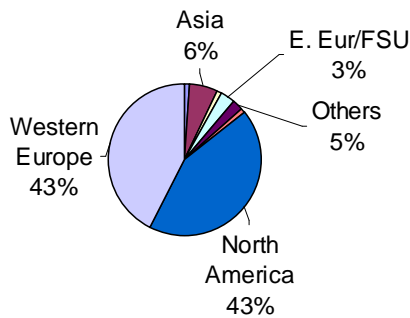


Figure 7-2: Marine Tourism – World Regions Segmentation 2005

Sector expenditure is headed by the US and Europe, where despite the growth of long haul holidays by residents, there are very large amounts of ‘domestic’ (within region) expenditure.³⁰

Marine Tourism	2005	2010
World €M	173739	204614
Europe €M	73966	85747

Definition – All expenditure excluding travel and accommodation.

Methodology – Estimation of total world tourism based on World Tourism Organization (WTO) data, broken down by region and then we have assigned a proportion of each region’s total tourism to ‘marine tourism’ (based on each regions strengths in sub-sectors such as boating, cruise etc). Our forecasts and hind-casts are also based on WTO growth rate trends.

7.1. Overview

Marine Tourism is one of the world’s largest marine markets and is likely to show high growth in future years. However, the sector is a difficult one on which to gain precise information as there are no international statistics that chart its value. Therefore, we take a view working from the global tourism industry as a whole and calculating a percentage for marine tourism. This approach has its limitations and at best can only deliver an approximation.

We estimate the world marine tourism market will be €174bn in 2005, 10.5% of all tourism expenditure. This is a very large value and how much of it should be ascribed to ‘marine tourism’ is a subject of much controversy as each sub-sector and associated agency has its own view.

It is important to note that this total figure does not take into account travel to, and spending in, coastal areas, which if included would form a broad definition of the sector. Trying to narrow down the sector definition to include only such activities as **cruise** holidays, **leisure boating**, (both discussed in following

³⁰ Note: The above time series forecast does not take into account the occasional disruptions that occur to tourism as a result of political actions and natural disasters.

chapters) other water sports such as scuba diving, recreational fishing, etc., is more problematic as there is no internationally comparable information in this area that is readily available.

7.2. European Market

We value marine tourism in Western Europe at €74bn in 2005. We expect growth to continue its long-term trend in line with the World Tourism Organisation's forecast of 3% growth in European tourism to 2020.³¹ (We describe how we derive values for marine tourism below.)

Although much of Europe's marine tourism over the past 40 years has traditionally focused on the Mediterranean, strong growth is evident in Northern Europe and has been boosted by re-development of old port areas and new marinas.

Along Germany's Baltic coast, marine tourism is growing and in areas such as health and spa tourism, which has a long tradition in this area and is still continuing to be a very important factor. The Baltic is also a beneficiary of the so called 'special interest' and cultural cruises. The North Sea and the Baltic have many areas suitable for sailing. In the North Sea destinations such as Sylt, Amrum and St. Peter-Ording are popular and have well developed associated resorts. On the Baltic, the Schlei, Kiel Bay, Lübeck Bay and the Flensburg Firth are good for sailing and close to city sightseeing or one of many international sailing events.

There are many windsurfing schools, sailing training centres and hire centres throughout Germany.³² With a permit, it is also possible to fish off the coast of Germany (for example in Schleswig-Holstein's coastal waters) and deep-sea angling, although much of the angling in Germany is in-land. For divers, there is Europe's largest training and education centre in Duisburg, the DiveGasometer. Germany offers good wreck and cave diving especially off the Baltic coast. Other new and established marine leisure pursuits include wakeboarding, parasailing, jet skiing, kitesurfing, and waterskiing.

7.3. World Market

In general the tourism sector, including marine tourism, has grown significantly in recent decades and is a huge industry. (Expressing world totals in Euros seems to show a decline from 2002 to 2003, although in dollars the reverse is true, again demonstrating the depreciation of the dollar against other currencies.)

It is estimated that more than half of the world population lives 60 km or closer to the coast, with this proportion likely to increase, further boosting domestic tourism and leisure activities.

The available international tourism data normally refers to international tourism receipts, which does not include the huge domestic market. There is information available for the UK & US, which puts UK total tourism expenditure at €107bn in 2003, only 18% of which was from international tourists. The US situation is similar with 12% of expenditure from international tourists.

By making assumptions on the proportion of domestic to international tourism in each region, a total tourism value for the world can be estimated. In general, developing countries are thought to display the reverse situation of the likes of the US or UK, with high proportions of international tourism. By applying the proportions, by region, to the known data on international tourism receipts a figure of total tourism can be derived.³³ Total world tourism in 2004 is estimated at €1,586bn.

Then to estimate 'Marine Tourism' a percentage of each world region's total tourism was estimated. This gives the world marine tourism market in 2004 as €168bn, 10.5% of all tourism. This percentage varies widely between regions. North America shows the largest marine tourism industry in 2004 at €73bn, followed closely by Western Europe (€72bn), Asia (€0bn), Eastern Europe (€5bn) and Latin America (including the Caribbean) (€4bn).

³¹ World Tourism Organisation, *Tourism 2020 Vision*

³² http://www.germany-tourism.de/e/water_sports_sailing_and_sailboarding.html

³³ World Tourism Organisation, *Tourism Highlights Edition 2004*

The forecast for world international tourist arrivals suggests a 4.1% annual growth rate from 1995 through to 2020. Europe's growth rate is lower at 3% over the same period. Applying the varying regional percentage growth to marine tourism, a key aspect of total tourism, suggests a market value of €205bn in 2010, 3% world growth rate per year from 2005.

The growth of tourism in general is due to more leisure time, increased spending power and improved communication and transportation technologies. Improved communication will give tourists better information on destinations and activities. Improved transportation systems will enable quicker and more direct travel to previously inaccessible areas. Within the tourism sector generally, consumers are becoming more widely travelled and are demanding higher quality and more varied leisure experiences. 'Special interest tourism' within the marine context could be an area with considerable development potential.

As particular coastal destinations become more popular with tourists, overuse can lead to problems of pollution and over development, leading to an eventual decline in tourism. Sustainable tourism is of particular relevance within the Marine Tourism sector, as it depends upon the quality of the marine environment and sustainable tourism probably represents a significant business opportunity.

8. CRUISE

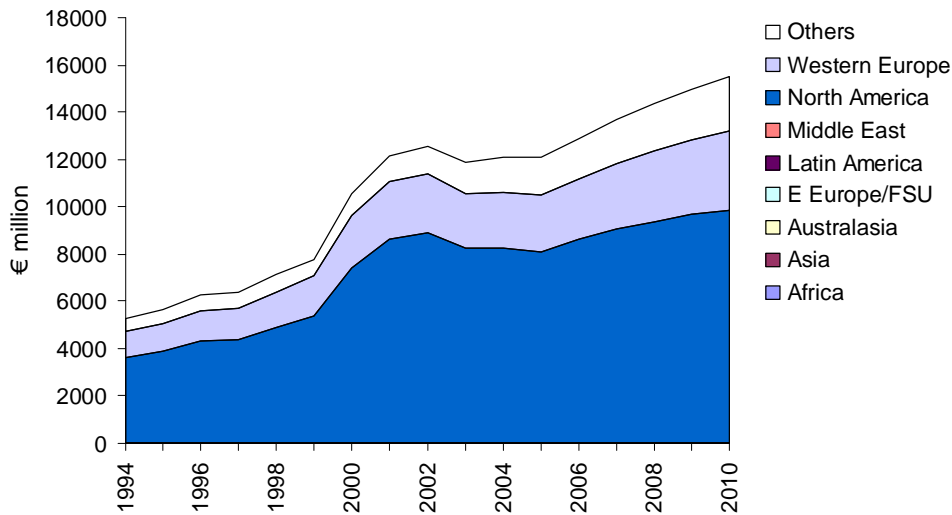


Figure 8-1: Cruise – World Market

Source: Douglas-Westwood

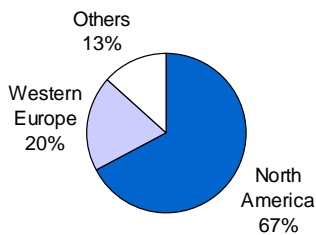


Figure 8-2: Cruise – World Regions Segmentation 2005

North American operations account for the largest share of the world’s cruise industry revenues, followed by Western Europe. ‘Others’ is believed to be mainly SE Asia, but data on this and individual countries is not generally available.

Cruise	2005	2010
World €M	12091	15501
Europe €M	1604	2273

Definition – Revenues of cruise vessel operators.

Methodology – Annual statistics from the International Council of Cruise Lines has been used for 2000 to 2003. Very high growth rates of 11%, 10% and 9% have been experienced, but we assume these will continue to moderate as the industry matures, reaching 2% by 2010. (European statistics are from cruise market specialist G P Wild.) The peak in 2001-2002 mainly relates to exchange rate distortions.

8.1. Overview

The cruise industry is a sub-set of Marine Tourism. It offers large growth potential with major investments being made in cruise terminals worldwide. The world market is of the order of €12bn; however, the total economic benefit is at least twice that value.

The cruise industry is US dominated and the US market is generally acknowledged to account for nearly 70% of passengers. The UK is the world’s second largest *source* market and strong growth is occurring in Germany. In mainland Europe, Spain is the largest source market – one result is that Bilbao is spending €13.2 million on a new cruise terminal. Asia was the fastest growing regional source market in the 1990s before regional economic problems, but growth is expected to resume again soon.

In 1997, the industry was estimated to be worth \$7bn annually and by 2003 total spending by the cruise lines and passengers in the US was \$12.9bn, but the total economic benefit was \$25.4bn resulting in the generation of 294,000 jobs.³⁴ US ports reported 7.1 million embarkations.

On average, a 2,000 passenger ship with 950 crew members generates some \$240,000 in on-shore spending per US port call. The average port-of-call passenger spends \$112 per visit.

In common with a number of the marine sectors the cruise industry is an international business. Passengers may fly from their home country in Europe to, say, Miami to join a cruise which visits a different Caribbean country each day. Each passenger is reported to spend \$112 per port visit. In 2003, direct purchases in Florida, home to the world’s largest cruise port Miami, totalled \$4.5bn.

In 2003 there were 258 cruise vessels registered. After a period of overbuilding of cruise vessels, and an anticipated downturn in passengers the cruise industry is again growing strongly. Since 2000, the US industry alone has added 20 ships with 50,000 ‘lower berths’. At the end of 2004, 21 ships were on order with a capacity of 55,000 lower berths.

8.2. European Market

Figure 8-3: European Cruise Sector Segmentation 2005

The UK, followed by Germany are the two largest cruise markets, although Spain is beginning to show growth.

This is a very complex market to analyse. Values in charts & tables above relate to port of embarkation. Different values and segmentations apply to source markets (origin of passengers), ports of call, cruise vessel companies’ locations and vessel owners’ locations. In addition, and in common with other sectors, much higher values apply to total economic benefit derived by a country than the value of the market shown here.

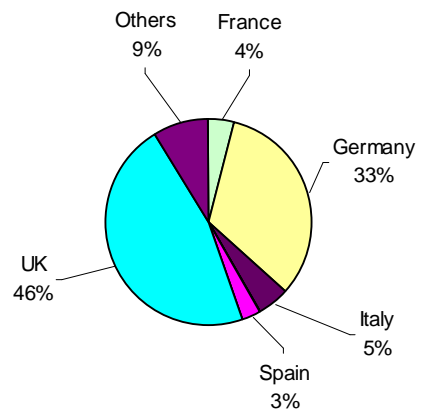
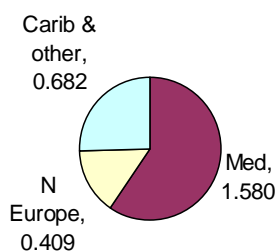


Figure 8-4: European Cruise Destinations (million passengers)



2.7 million Europeans took cruise holidays in 2003 and of these 2 million were in European waters.³⁵ This resulted in 8.5 million passenger calls in European ports.

Strong growth is expected with European passengers increasing to 4 million in 10 years. There is a significant growth of smaller specialised cruises in Northern European waters. (This mirrors the reported increasing use of smaller ports by the US industry, but in the US much of this is generated by passengers driving to embarkation ports. The growth of the US “drive-to” market and indeed some of the strong US growth may be a function of passengers’ reluctance to fly after 9/11.)

³⁴ *The Cruise Industry 2003 Economic Survey in the US*. International Council of Cruise Lines

³⁵ European Cruise Council 2004 (first statistics)

Table 8-1: Cruise Ships by Owner (end 2003)

Source: ISL

Cruise industry operators are primarily US-based, followed by Norway. A characteristic of the main players is the large size of their vessels. The average age of the fleet is about 18 years with Greece being the exception at 37 years.

Europe enjoys a fairly short peak cruising season, especially in the North, and as a result its ports rarely get near the world top 20. However, they are becoming increasingly popular as cruise destinations and many of them are also developing attractive new terminal facilities.

	<i>ships</i>	<i>berths</i>	<i>av. berths</i>
US	85	118,340	1,392
Norway	37	62,540	1,690
Malaysia	18	28,462	1,581
Greece	21	13,622	649
Japan	8	5,921	740
Monaco	12	6,217	518
France	5	5,038	1,008
UK	8	6,439	805
Switzerland	5	4,648	930
Germany	8	2,856	357
Others	51	20,481	402
total	258	274,564	1,064

Table 8-2: European Passenger Embarkations, Disembarkations & Calls. Country Totals 2003

Source: GP Wild (International) Limited and Lloyd's Cruise International Aug/Sept 2004

Tables 8.2 and 8.3 give numbers of passengers at various European countries and ports from 2002 to 2004. The data shows total numbers of cruise passengers embarking, disembarking and calling at each port.³⁶

GP Wild International's '*Cruise Europe*' annual statistics show that member ports in Northern Europe received 2% more passengers in 2002 (2,723,613), compared to 2001 (2,671,369) and up 12.5% on 2000 (2,421,038). Growth in passenger numbers, generally in Europe, were affected in 2002 by 9/11, with passengers increasing only slightly on the previous year and calls actually decreasing, (offset by an average of more passengers per vessel.) The effect of 9/11 can be illustrated by a drop in US cruise passengers in Northern Europe of almost 20% between 2001 and 2002.

In mainland Europe, Spain is one of the largest areas of activity – one result is that Bilbao is spending €13.2 million on a new cruise terminal. Barcelona, from available data, is the single busiest cruise port in Europe, with a total of 832,853 passengers either embarking, disembarking or calling at the port in 2004 (see Table 8.3). In 2003, Southampton, UK, completed an \$18 million (€15.9 million) investment in cruise facilities, including the opening of a third terminal and extensive reconstruction and refurbishment of the two existing terminals.

<i>Country</i>	<i>Total</i>
Italy	2,994,985
Greece	2,199,339
Spain	2,055,181
UK	727,115
France	637,255
Turkey	507,681
Cyprus	386,513
Norway	375,584
Finland	364,807
Croatia	364,677
Portugal	303,264
Sweden	287,797
Denmark	271,582
Germany	268,080
Malta	243,455
Russia	192,393
Estonia	182,538
Latvia	100,460
Netherlands	79,324
Poland	49,534
Iceland	32,243
Ireland	29,706
TOTAL	12,653,513

³⁶ Data is from GP Wild International and some German data from Michael Jarowinsky (MC). Actual data used where possible and estimated values used in other cases. The most complete data available is for 2003, therefore making it the best source of information to compare countries and individual ports.

Table 8-3: European Ports Passenger Embarkations, Disembarkations & Calls 2002-04Source: GP Wild (International) Limited, European Ports 2003 & in *Lloyd's Cruise International* Aug/Sept 2004

<i>Port</i>	<i>Country</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>
Dubrovnik	Croatia	683,840	364,677	370,617
Limassol	Cyprus	378,396	386,513	
Copenhagen	Denmark	173,000	271,582	335,056
Tallinn	Estonia	127,392	182,538	198,205
Helsinki	Finland	127,219	364,807	350,570
Marseille	France		349,176	
Nice-Villefranche	France	299,467	253,142	
Le Havre	France	40,674	34,937	29,628
Warnemunde/Rostock	Germany	77,656	95,092	92,209
Kiel	Germany	65,940	93,172	128,604
Bremerhaven	Germany	50,423	49,304	61,814
Hamburg/North Sea	Germany	25,452	30,512	26,358
Piraeus	Greece	387,697	594,751	492,985
Rhodes	Greece	-	370,661	-
Santorini	Greece	-	281,168	-
Mykonos	Greece		267,373	
Corfu	Greece		248,637	
Katakolon	Greece		177,784	
Heraklion	Greece		150,203	
Patmos	Greece		108,762	
Reykjavik	Iceland	30,077	32,243	39,060
Cork/Cobh	Ireland	-	-	32,003
Dublin	Ireland	30,000	29,706	43,121
Genoa	Italy	567,506	689,455	-
Venice	Italy	507,547	669,566	637,258
Civitavecchia	Italy	-	432,811	521,616
Naples	Italy	-	413,135	535,590
Livorno	Italy	297,748	311,906	360,753
Savona	Italy	-	167,138	468,876
Palermo	Italy	197,434	164,641	
Bari	Italy	203,512	146,333	
Riga	Latvia	108,186	100,460	52,621
Valletta	Malta	356,031	243,455	-
Amsterdam	Netherlands	76,822	79,324	82,955
Oslo	Norway	86,408	112,131	127,893
Bergen	Norway	123,369	103,332	122,361
Flam	Norway	58,576	52,069	-
Tromso	Norway	40,873	45,783	33,111
Honningsvag/Nordkapp	Norway	-	34,398	39,871
Trondheim	Norway	30,071	27,871	
Gdynia	Poland	53,330	49,534	62,734
Funchal	Portugal		192,061	
Lisbon	Portugal	164,259	111,203	197,855
St Petersburg	Russia	142,647	192,393	242,862
Barcelona	Spain	843,686	798,151	832,853
Palma Majorca	Spain	658,443	722,429	664,568
Malaga	Spain	162,803	180,143	
Cadiz	Spain	114,664	41,882	112,791
Vigo	Spain			84,181
Tenerife	Spain	238,908	175,190	-
Lanzarote	Spain		137,386	
Stockholm	Sweden	136,596	201,852	197,964
Visby	Sweden	78,249	85,945	71,267
Kusadasi	Turkey		296,607	
Istanbul	Turkey		211,074	
Southampton	UK	386,000	418,629	536,493
Dover	UK	134,127	157,237	195,543
Harwich	UK	78,600	90,153	86,843
Guernsey	UK	19,200	33,035	50,027
Falmouth	UK	22,067	28,061	23,344

In 2004, Italy was the most popular country in Europe as a cruise *destination* (based on available data), with almost 3 billion visitors. Greece and Spain ranked second and third with 2.2 billion and just over 2 billion passengers respectively. Many of the leading ports are situated in the Baltic. Dubrovnik's data seems very high (Table 8.3), which could suggest a broader definition is being applied by Croatia than for other countries (i.e. cruises of fewer than two nights, etc, are included).

Germany saw over 300 million cruise passengers pass through its ports in 2004, up from 268 million in 2003. Kiel, has shown a major growth in passenger numbers since 2002 with 65,940 passengers to 128,604 passengers in 2004, almost double. Although this growth is not universal, with Rostock/Warnemünde experiencing a slight decline in passenger numbers between 2003 and 2004, from 95,092 to 92,209.

Bremerhaven and Hamburg have both shown a slight increase in numbers from 2002 to 2004. The Columbus Cruise Center at Bremerhaven opened in 2003, following a €21 million investment. The work included a new bus station, passenger boarding bridges, additional parking space, improved passenger and baggage handling and ISPS security operations. The port has excellent traffic infrastructure with access to major German and European tourist centres and three airports offering national and international flights within 45 minutes' reach.³⁷

In total, cruise companies in the German market booked 537,348 passengers in 2003, a rise of 25% over the post-9/11 season 2001. Some believe that within a few years Germany's 0.8% market will be comparable with the UK where 2% take cruises and the US, where the figure is 3.6%.³⁸

Over the past few years German yards have experienced difficulties in winning ocean-going cruise ship orders, with only Meyer Weft reported as having ocean-going cruise ships in build in mid 2004. However, this could change due to the ending of the controversial production restrictions clamped on former GDR yards by the EU in the 1990s. Yards have been particularly hit by exchange rate changes.

³⁷ 'Top Ten European Ports', GP Wild International, 2003

³⁸ *Lloyd's Cruise International*, pp31-35 Aug/Sept 2004. (These numbers probably also include German inland cruises – ed.)

9. YACHT & BOATBUILDING

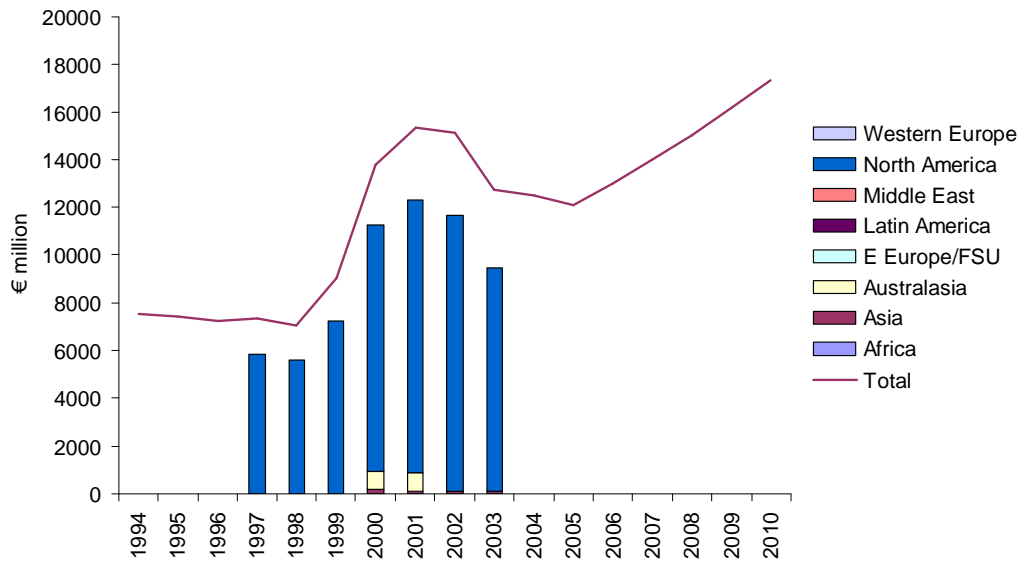


Figure 9-1: Yacht & Boatbuilding – World Market

Source: Douglas-Westwood, ICOMIA, BMF

Yacht & Boatbuilding	2005	2010
World €M	12109	17303
Europe €M	-	-

Definition – Sales of new leisure boats.

Methodology – The world timeline is calculated from the total of all available data for the major boatbuilding countries new boat sales and uses the assumption (as stated by the British Marine Federation) that the USA constitutes 80% of the world’s market for leisure marine products.³⁹

9.1. Overview

We estimate the world yacht & boat building market in 2004 as €12.5bn. Yacht & boatbuilding is part of the Leisure Boating sector (which includes marina operations, and other operational expenditure, chandlery, motor sales, etc., but data is incomplete on this wide definition).⁴⁰

Leisure boating has a considerable economic impact. Within some of the European countries, the total leisure boating sector is typically 7 to 8 times the value of new yacht & boat sales. In addition, it has been estimated that in the UK, for every £ spent on boating, 6 times that amount is spent onshore, (restaurants, travel, etc.) bringing considerable benefit to businesses.

The timeline from 1994 to 2010 has only been attempted at a world scale, as the data is often unavailable for individual countries, with the result that estimation of trends based on such information would be

³⁹ www.britishmarine.co.uk

⁴⁰ The basis of the data in this sector is information from the ICOMIA (International Council of Marine Industry Associations) reports published each year. In addition, information from the BMF (British Marine Federation) and the US’s NMMA (National Marine Manufacturers Association) has been analysed. Within the ICOMIA statistics, there is information on selected European countries, and others, for the value of ‘new boat sales’. For some countries there is also information on PWCs (personal water craft), marine equipment and boat accessories. As not all countries supply this information (and with those that do, it is not every year), it is difficult to make comparisons using this broader definition of ‘Leisure Boating’. Therefore for the sake of consistency the narrower ‘New Boat Sales’ is the definition of ‘Yacht and Boat Building’ for the purposes of this analysis.

meaningless. Where available, country level information for individual years has been included in the appendices.

9.2. World Market

Country	Per capita boat ownership
Sweden	1:7
USA	1:16
Netherlands	1:30
France	1:66
Italy	1:67
UK	1:100
Germany	1:108
Poland	1:471
South Africa	1:1,700

Table 9-1: Per Capita Boat Ownership

Source: international boat industry

There are considerable variations in levels of boat ownership amongst the coastal countries. This is mainly an economic factor with very low levels of ownership in developing countries and similar levels of boating activity in developed countries such as Germany, the UK, France and Italy. In general, there is a lower level of interest in boating in China, although the experience of Taiwan suggests this may change.

Our estimate of the world yacht & boat building market in 2004 as €12.5bn is calculated from the total of all available data for major boatbuilding countries' sales. The BMF suggests that the US market is worth 4/5 of the world. Based on this a total of €11.5bn is reached for the world's new boat sales in 2004. Expressing world totals in Euros seems to show a decline from 2002 to 2003, although in dollars there is a gradual growth, again demonstrating the effect of the depreciation of the dollar against the euro. As the majority of the market value originates in the US, the forecast and hindcast for global market value has been estimated in dollars and converted to Euros afterwards.

Generally the Leisure Boating market, of which new boat sales are a significant part, is a cyclical industry, reflecting countries GDP growth. As spend on leisure boating is 'discretionary' it is one of the industries first to suffer in times of recession.⁴¹

The manufacturing sector is experiencing consolidation and those involved in exporting are feeling the benefits.

There is an ongoing trend towards the sales of larger high specification boats, especially over 24 metres (super yachts).

9.3. European Countries

Six million boats are owned by Europeans reflecting the popularity of boating as a pastime, with over 130,000 boats manufactured in 30 European countries in 2003.⁴² The European leisure boating industry employs over a quarter of a million people.⁴³ Germany, France, Italy and the UK account for two thirds of retail spending and 63% of industry revenues.

Germany's industry is mixed, with local demand fairly low, but exporters are doing very well in the sailing boat and super yacht sectors, but cheap British and US imports are having an impact due to the strength of the Euro. German new boat sales were static from 2000 to 2003, at about €230 million.

France's industry more than doubled its new boat sales between 2001 and 2002 from €297 million to €627 million and then decreasing to €343 million in 2003. This decline could be due to very low growth in GDP in 2003 and high unemployment.

Italy's industry is the largest in value (almost €3bn in new boat sales in 2003), with the highest levels of boat building activity, heavily influenced by the luxury and super yacht sector. There are high levels of local expenditure and exports. New boat sales have been increasing at a healthy rate from €1.3bn in 2000 to almost €2bn in 2003.

⁴¹ ICOMIA, *Boating Industry Statistics*, 2003

⁴² *British Marine News*, June 2004, p10

⁴³ *British Marine News*, March 2003, p1

The UK leisure boating market has seen sustained growth in recent years, although in Euros this may be not so apparent (€349 million, 2004). Demand is very high for all boats (sail and power) exceeding 10 metres. Recent events such as the war in Iraq have failed to dent consumer spending, and unemployment remains low.⁴⁴

9.4. Superyachts

Leisure boating involves craft of many sizes, from the sailing dingy to the superyacht. Superyachts (yachts >80 feet in length), represent a particularly important sector for some countries with 651 presently on order worldwide. Market leaders are Italy, the US, the Netherlands, the UK, Taiwan, Germany and New Zealand.

The development of the sector in Taiwan is particularly interesting as the leisure boatbuilding sector has been in decline. Increasing costs caused the leisure boat building sector to fall from \$200M in 1987 to \$75M in 1994 and 70% of the yards closed. The remaining players ventured into luxury yacht production and revenues grew to an estimated \$180M (€144M) in 2004. A special yacht manufacturing zone is now being built in southern Taiwan.⁴⁵

9.5. Challenges

Within some parts of Europe, there is already pressure on berths within marinas. Within the UK and Ireland their marine federations are campaigning for marina development to increase the number of berths. It is difficult to sell new boats to consumers if they do not have anywhere to store them. Italy has already taken the initiative and has a programme for building 50 new marinas in the next nine years.⁴⁶

In addition, imports from the US are also cheaper, due to the weak dollar, which could affect boatbuilding all over Europe as retail prices decrease along with profit margins. In the US, with unemployment falling and inflation being low, new boat sales increased considerably between 1999 and 2000 and have been maintained since then at approximately €9.4bn in 2003 (\$10.6bn).

⁴⁴ www.ibinews.com

⁴⁵ *Financial Times*, p28, 31 Jan 05

⁴⁶ *Financial Times*, p5, 18 Jan 05

10. OCEAN SURVEY

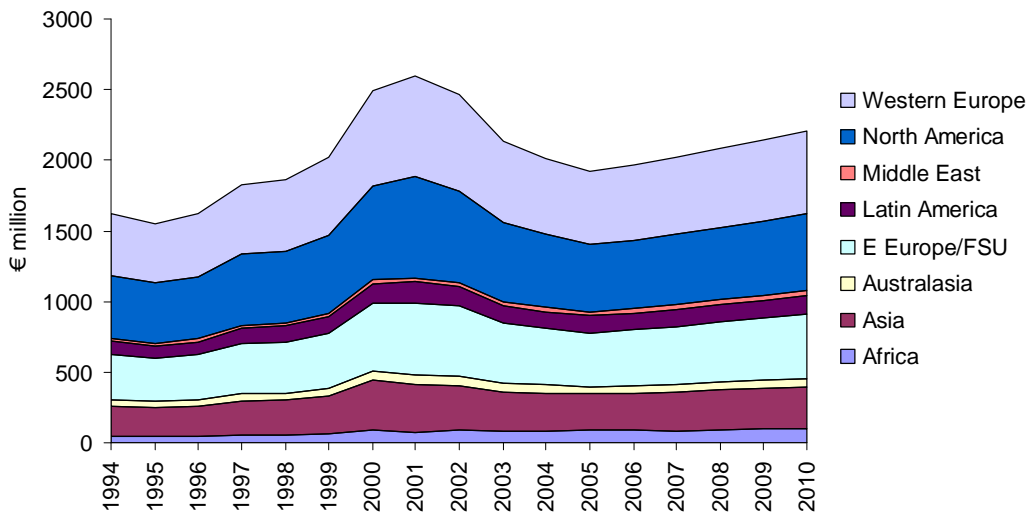


Figure 10-1: Ocean Survey – World Market

Source: Douglas-Westwood

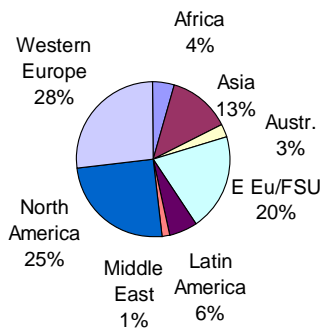


Figure 10-2: Ocean Survey – World Regions Segmentation 2005

Europe and the USA are the key markets for Ocean Survey. European contractors are market leaders in the commercial sector.

Ocean Survey	2005	2010
World €M	1925	2209
Europe €M	518	591

Definition – Seabed and shallow seismic survey for civil purposes. (Excludes oil & gas deep seismic survey.)
Methodology – Analysis of individual ocean survey sectors and their markets, based on values developed for ‘The World Ocean Survey Report’ by Douglas-Westwood.

10.1. Overview

Survey of the oceans for civilian purposes has a number of distinct sectors including hydrographic survey for the production of navigation charts, exploration and development of oil & gas reserves, port & harbours, submarine cable routes, windfarms installations, etc. Germany is an important supplier of technology to this sector.

Our five-year forecast shows hydrographic charting as the largest sector, followed by oil & gas and port & harbour survey.⁴⁷

We forecast that the world market will exhibit a long-term growth trend, with Western Europe and North America continuing to be the regions of greatest activity.

Ocean Survey is a large activity, with some 737 vessels worldwide having significant survey capability. The number of vessels operated by national hydrographic agencies alone total 322 and these have crews exceeding 8,700 people.⁴⁸

⁴⁷ Note: We exclude oil & gas seismic survey from this sector.

⁴⁸ ‘IHO Yearbook 2003’

The production of hydrographic survey equipment is also a major activity (although we exclude it from this section as it belongs in Underwater Technology). When this is included, our view is that perhaps 18,000 people are employed in various forms of activities related to ocean survey worldwide.

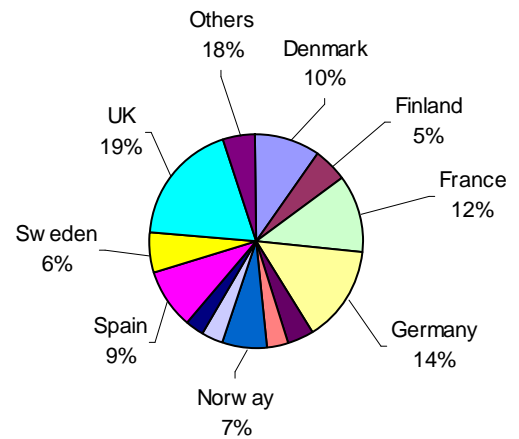
Due to the impact of external factors, the commercial contracting industry has experienced major cycles. 1999 represented a cyclical low due to the impact of the 1998 oil price fall, but in 2000 business rose strongly from the submarine cable sector which itself collapsed in 2001-2002. The submarine cable sector had attracted significant resources that were released into the wider market in 2001-2, depressing prices.

The commercial industry has now turned around and seems set for a period of steady growth.

10.2. European Market

Figure 10-3: European Ocean Survey Segmentation 2005

The UK forms the largest European market due to the combination of its oil & gas industry surveys and hydrographic activity. Norway is also significant due to its oil & gas. The activity in the other significant markets is mainly a function of hydrographic activities. Germany has significant expenditure in the sector.



10.3. Business Sectors

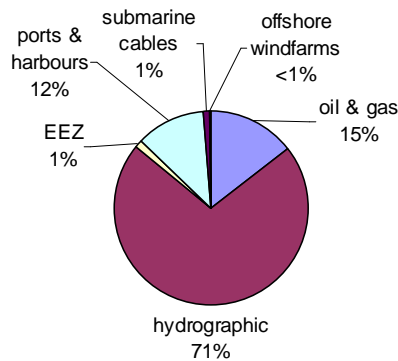


Figure 10-4: Ocean Survey – Sectors

Source: The World Ocean Survey Report, Douglas-Westwood.

The largest activity is **hydrographic survey**, a ‘market’ we value at €1.4bn. This is the process that is used to produce the navigational charts essential for safe transit of vessels. Surveys are usually commissioned by nations’ hydrographic offices, often using naval survey vessels plus, in some instances, civil contractors. In addition there is a major activity in support of defence requirements (such as the navigation of nuclear submarines) but this is excluded from this report.

It is very difficult to determine the total world expenditure on hydrography as only 16 of the IHO listed countries report their figures. The known expenditure of the 16 countries totals €438 million for production of about one quarter of the world’s marine charts, so perhaps a total annual spend of at least €1.4bn. We say *at least* as much of the survey operation is, in many cases, carried out using naval vessels and personnel and in most instances the cost of these are probably not included in these figures.

Offshore oil & gas industry survey is valued at €296 million in 2005. The industry relies upon survey & positioning for exploration and facilities planning, construction and maintenance and this forms the largest commercial activity. Exploration surveys (excluded from this report) carried out by seismic survey vessels locate and map the reservoirs. This phase also includes exploration drilling using rigs that must be precisely positioned and orientated. The planning and installation of offshore production platforms and pipelines requires accurate survey techniques and precise positioning.

For nearly two decades Western Europe was the world’s largest offshore oil & gas survey market and then during the 1990s the North Sea followed the US Gulf of Mexico into maturity and then into the beginnings

of long-term decline. The Gulf of Mexico meanwhile received a new lease of life as deepwater fields were developed.

Over the next five years we expect Africa to show greatest growth, and to a lesser extent Latin America, but North America (mainly the US Gulf of Mexico) will decline. Growth mainly relates to the field development activity. Although business in individual regions will change, the overall effect is one of a reasonably constant oil & gas industry world market as declines in mature regions are balanced by gains in others.

Ports & harbours – €220 million (2005). Most of the tonnage of international cargo is moved by sea and this involves the use of over 7,000 ports & harbours world-wide and over 2,000 of these can be regarded as significant ports – in other words, they carry out survey work. Major commercial ports do this using in-house hydrographers although there is a small amount of contracted commercial activity.

Although there is a requirement to conduct the survey of ports and harbours on an ongoing basis, the amount of money available for this process is fundamentally a function of the number of ship movements through ports. The tonnage of goods moved by sea is a function of national GDP and the above table is based on our views of regional GDP growth over the period. The routine expenditure patterns are complicated by major port development but as these tend to stretch over several years the effect is ‘smoothed’ significantly.

We expect a continuing growth in port & harbour survey expenditure, with the US being by far the largest region. Here the US Army Corps of Engineers is responsible for a considerable proportion of national expenditure.

Exclusive economic zones – €23 million (2005). The definition of exclusive economic zones (EEZ) outside the 200nm limit under the United Nations Convention on Law of the Sea (UNCLOS) requires the use of S&P to determine the location of the outer edge of the continental margin at a depth of 2,500m. A successful claim can give a nation rights over hundreds of thousands of kilometres of ‘seabed real estate’ and the associated oil, gas and mineral rights.

EEZ survey is a particularly difficult market to value. Considerable survey work is required by nations to prove-up the basis for their claims and this may be carried out by survey vessels operated by national hydrographic offices or navies, by research organisations, by commercial contractors or a combination of all three. Whatever resources are used these surveys, although few in number, are of significant scope and cost.

A further complicating factor in market valuation is the seeming secrecy reported by some informed individuals. However, some costs (such as the major Irish EEZ survey) are in the public domain and from this and known tender opportunities a view of expenditure can be given. Overall, we expect a general rise in spend over the period.

Submarine cables – €21 million (2005). Route survey is a critical part of the installation of submarine cables and is now even more so due to changes in fishing and shipping activities. This activity collapsed with the end of the ‘dotcom’ stock market boom and released additional capacity into the other S&P sectors.

After a rapid climb to an annual peak of nearly \$96 million in 2000, the installation, and correspondingly the survey of submarine cable routes, virtually ground to a halt in 2002. This had the spin-off effect of releasing survey capacity (and ROVs working on cable burial) into the major market sector, oil & gas, elongating a period of low prices caused by the earlier oil price fall. A further, but less publicised factor was the development of technology allowing more capacity on the fibre-optic cables. A very slow upturn in business is expected as the global economy recovers.

Offshore windfarms – €3 million (2005). The identification and assessment of locations suitable for offshore windfarms (and in the future wave and ocean current devices) involves the S&P industry in the mapping of the seabed environment.

There are many other small activities. These include location and mapping of **shipwrecks** and **downed aircraft**, **sea bed mining** of minerals ranging from diamonds to sand & gravel, installation of **electricity cables** to offshore islands, etc. Due to their small size or intermittent nature we do not value such activities in this report.

Although there has been strong development in the business of supplying electronic charts, there is little evidence to date of the commercial survey contractors becoming involved in a sector that offers significant business opportunities and diversification potential.

10.4. Challenges

Ocean survey is a technology business with large amounts of money invested in survey vessel's data gathering and processing systems. Major advances of the past decade have included the almost universal use of multibeam sonars as the primary tool for data gathering, differential global positioning (DGPS) as the primary navigation tool and use of advanced sonar data processing.

Ocean survey technology is probably more likely to move forward in a process of incremental developments rather than by major breakthroughs. Examples of the former include the commercial application of synthetic array sonar (itself an old concept increasingly enabled by the improvements in underwater positioning) and the application of increasing amounts of processing power.

In our view, major potential lies in the application of AUVs. Long a tool of academia, outstanding results have been obtained in deepwater commercial operations in the Gulf of Mexico, off West Africa and the North Sea. However, the major challenge and indeed opportunity lies in applying the technology to increase survey efficiency in lesser water depths and attack the commercial dominance of the survey vessel as the survey platform.

Ongoing survey of the sea and oceans is a fundamental need for the continuance of world trade and the extraction of ocean resources. Increased awareness of the importance of the oceans to the overall environment is likely to increase spending on ocean survey.

Much of the work carried out by countries' hydrographic offices for the production of navigation charts is based on data gathered by naval survey vessels, a practice which is difficult to economically justify in a situation where such services can be bought cheaper from commercial contractors. However, we expect the economic argument will increasingly prevail.

The growth ambitions of the main commercial contractors together with the fall-out results of business cycles has meant that rationalisation and consolidation activities have been extensive in the S&P market with only one truly global player (Fugro – Netherlands) and two mid size ones (C&C – US and (Gardline – UK) together with a number of small, mainly national players.

We have long believed that for many commercial contractors ocean survey is a market that is too small to meet their shareholders' growth objectives and companies are expanding their activities into areas such as seismic survey.

Although there has been strong development in the business of supplying electronic charts, there is little evidence to date of the commercial survey contractors becoming involved in a sector that offers significant business opportunities and diversification potential.

Although it has been seen to experience business cycles, survey of the oceans is a long-term business that will continue to offer significant opportunities for organisations and individuals capable of commercial and technical innovation. In many respects hydrographic survey contracting itself is over-supplied with small local players. However, much of the technology used by the business is produced in relatively small numbers and continues to offer opportunities for niche players.

11. FISHING

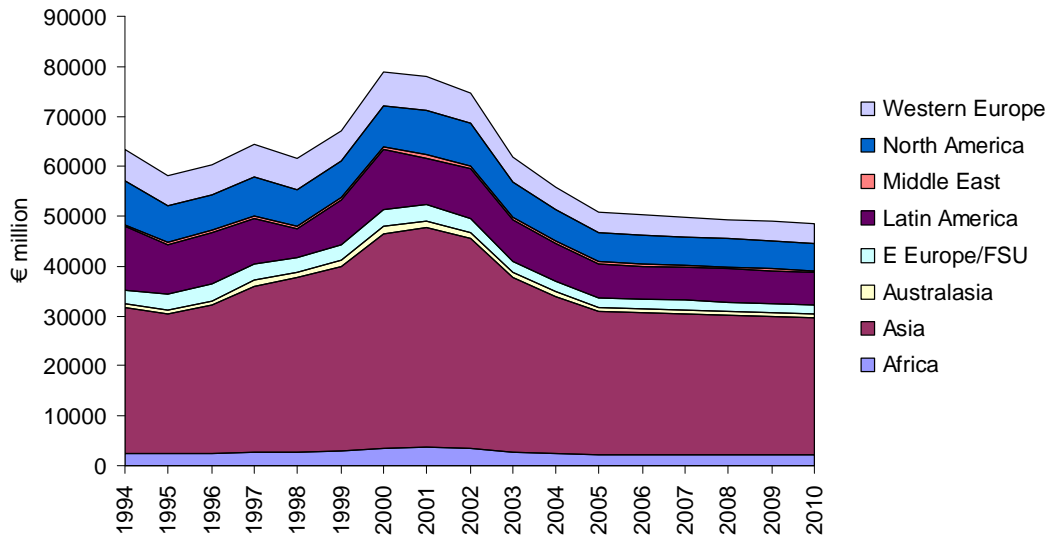


Figure 11-1: Fishing – World Market

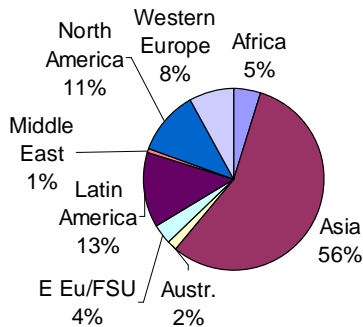


Figure 11-2: Fishing – World Regions Segmentation 2005

The capture fishing industry is dominated by Asia and the other developing countries. European activity is greatly limited by restricted stocks.

Fishing	2005	2010
World €M	50713	48478
Europe €M	4064	3885

Definition – Value of fish and shellfish landings as defined by the FAO.

Methodology – Use of FAO data within the ‘Eurostat’ databases to generate country and regional marine capture fishing production tables by weight, then applying the value of production, using the FAO’s ‘World Fishery production, estimated value by groups of species’. The forecasts are a continuation of the current trends, based on existing production data. Detailed tables of value and tonnage of production can be found in the appendices.

11.1. Overview

Fishing is an important industry that is seeing growing demand, but the world catch tonnage is falling as a result of serious resource problems and quota restrictions. There are some opportunities offered by new species, however, aquaculture which is subsidized in a number of countries provides serious price competition. The industry faces a future of continuing global decline worldwide until a point of sustainability can be reached.

Since 1996 capture fishing tonnage has been at best flat and has shown recent decline. The growing world demand for fish and other seafood is being met by aquaculture where tonnage growth over the period 1996 to 2002 averaged 7% and \$ value averaged annual growth of 4%.

Our five-year forecasts assume the market value will stay constant from 2002 prices onwards. This assumption has been made on the basis of increasing production of fish (including shellfish) from

aquaculture, keeping prices steady. (The fall shown in the chart above occurred due to changing exchange rates between the US dollar and euro.)

Due to initiatives such as the CFP (Common Fisheries Policy) within the EU, aimed at conserving remaining fish stocks, future increases in the total volume of captured fish worldwide is unlikely and has been decreasing recently. This decrease may appear more pronounced if the speculation that China is over-reporting its production, by as much as 43%, are to be believed.⁴⁹ In addition, the depreciation of the US dollar against the Euro makes the decline more pronounced than if displayed in dollars.

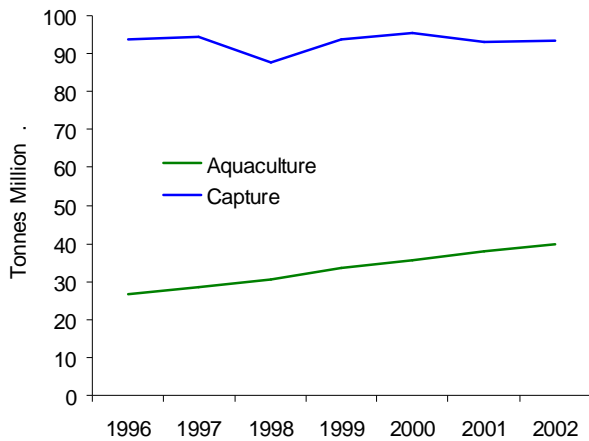


Figure 11-3: Fishing and Aquaculture Production

In the appendices the marine fishing market can be viewed by tonnage and by value. The values are derived from tonnage data in the Eurostat online database and further broken down into molluscs & crustaceans (shellfish) and demersal & pelagic (finfish). The value of each of these subsets was estimated, by country, using the FAO 'World Fishery Production: estimated value by group of species' table, containing annual data from 1999-2002.

11.2. European Market

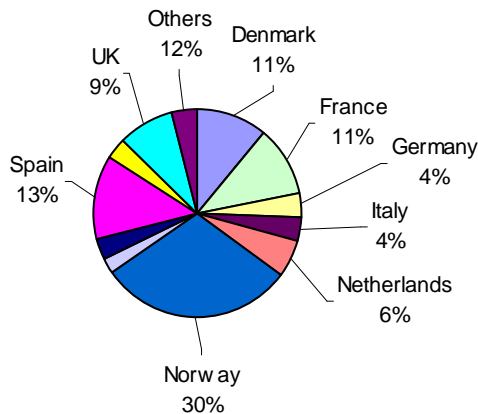


Figure 11-4: European Fishing Sector Segmentation 2005

Within the EU the UK, Spain, France and Denmark all have markets valued at approximately half a billion Euros each, although within the whole of Europe Norway is the clear leader, with a market three times the size at €1.49bn in 2003. The expansion of the EU member states in 2003 has increased competition. Outside the EU, a negative effect of the weak dollar has been felt, due to exports from the EU becoming more expensive for non-EU consumers.

11.3. World Market

The global fishing industry is in decline, while demand has grown dramatically. In the last 50 years fish consumption per person has doubled. Japan, the US and the EU are major seafood markets that depend on imports for approximately half of their consumption.⁵⁰ Europe's fishing production amounted to 8% of world production in 2004 (€4.5bn). The value of Asian production was way ahead of any other world region in 2004, at over €31bn. Latin America's value was nearly a quarter of Asia's, with North America not far behind.

World fish consumption has been increasing since the 1960s, due to population increase and lifestyle factors, such as increased awareness of health benefits. Fishing technology has advanced over the years to increase catches. As a result of this over fishing (and pollution) the ocean population of edible fish has

⁴⁹ Delgado, C et al, *FAO, The future of fish, Issues and trends to 2020*

⁵⁰ *FAO, Projection of World Fishery Production in 2010*

decreased by 90% during the last 50 years. The only way to bridge the gap between reduced capture fisheries output and increased world demand is through aquaculture and fish farming.

11.4. Challenges

The future increase in fish production is expected to come from aquaculture, which is growing rapidly. The contribution from capture fisheries will depend on how effectively countries and regions can manage their fish stocks to sustain current stocks or optimistically to increase fishable stocks.

The International Food Policy Institute and the FAO are collaborating on IMPACT, a global model of food supply and demand for 28 commodities. A paper based on results in 2002 offered the following projections:⁵¹

- Global fish production is forecast to rise at 1.5% through to 2020.
- Most growth will occur in developing countries which will account for 79% of production by then.
- China's share of production will grow whilst Japan, USA, EU and FSU contract.
- Real prices will increase by 4-16%.
- Fishmeal and oil prices will rise by 18% as these are increasingly concentrated into aquaculture.
- The share of aquaculture will increase worldwide.

⁵¹ Delgado, C et al. *Fish as Food, Projections to 2020*

12. MARINE AQUACULTURE

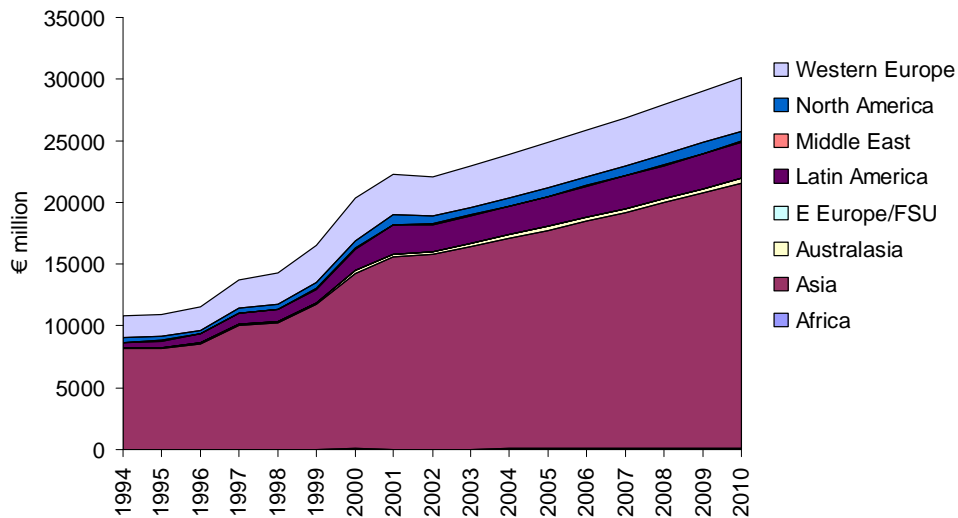


Figure 12-1: Marine Aquaculture – World Market

Source: Douglas-Westwood

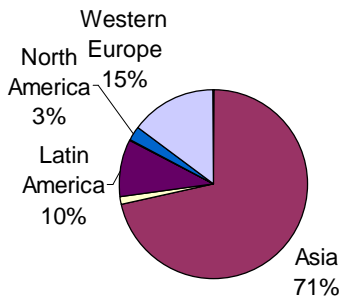


Figure 12-2: Marine Aquaculture – World Regions Segmentation 2005

Asia dominates aquaculture production, followed by Europe and Latin America.

Marine Aquaculture	2005	2010
World €M	24831	30166
Europe €M	3623	4401

Definition – Value of ‘farmed’ fish and shellfish as defined by the FAO.

Methodology – Use of FAO data within the ‘Eurostat’ databases to generate country and regional marine aquaculture production tables, by value. The forecasts are a continuation of the current trends, based on existing production data. Detailed tables of value and tonnage of production can be found in the appendices.

12.1. Overview

Due to the decline in global capture fishing and increasing consumer demand and the low prices of its products, aquaculture is the fastest growing sector in the food industry.⁵² Less than half of all aquaculture production comes from marine aquaculture; the rest comes from freshwater areas.

SE Asia is a low cost producer and its exports have had particular impact in the US where, despite a growth in fish and seafood consumption, harvest values for nearly every species have declined in 2001-2. (This also impacted on US capture fishing values which declined 4% in 2002.)

Environmental issues and scares have at times depressed demand but this quickly recovered. Norway leads European production and benefits from a strong international brand much evident in the US.

Between 1996 and 2002 annual average tonnage growth was 7% and growth in US\$ terms 4%. Continuing strong future growth in demand is forecast. On a global basis investment in aquaculture will be critical in

⁵² The State of World Fisheries and Aquaculture 2002, SOFIA

growing world fish output. There are opportunities for new species development and research opportunities in a number of areas.

12.2. Europe

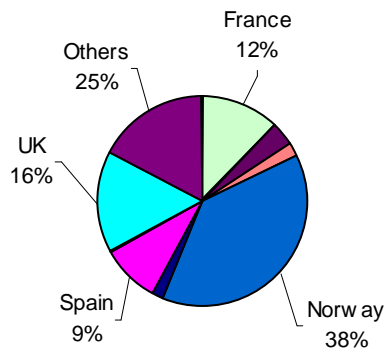


Figure 12-3: European Marine Aquaculture Sector Segmentation 2005

Within marine aquaculture (excluding seaweed) Western Europe at 15% is ranked second to Asia in regional production value, but this is only a fifth of Asia's. According to available data Eastern Europe's market is very small compared to Western Europe. As within the capture fisheries, Norway is the European market leader by far with the combined production from the UK, France and Spain equalling it.

Total European (EU25) production has grown by more than 40%, from 1 million tonnes in 1993 to 1.4 million in 1999, and then declined very slightly.⁵³ France, Italy, Norway, Spain and the UK are the largest players. Norwegian production at 554,000 tonnes in 2002 is nearly twice that of its nearest rival Spain. (By comparison, Japan produces about 1.3 million tonnes.)

12.3. World Market

With 70% of the world's production Asia is the world market leader. Production is valued at just over €17bn in 2004, much of which supplies their own domestic markets. Forecast data from 2003/4 onwards assumes a continuation of growth rate in the volume of marine aquaculture produced at 4% per year.⁵⁴ As with capture fishing, the Asian values must be treated with caution, due to the large Chinese content and the scepticism surrounding the high level of reported production (FAO).

12.4. Challenges

The reputation of farmed fish suffered with the publishing of a report in *'Science'* in 2004, on the levels of chemicals within the fish. The effect the article had highlights how vulnerable the industry is to negative press. Aquaculturists' freedom to improve fish is limited by the need to consider the effects of new or modified fish on the aquatic ecosystem and human health. The industry has to become more united and sophisticated in its approach to marketing and promoting the sustainability and health benefits of farmed seafood.⁵⁵

It is thought that the US and Europe will continue to experience increased imports from Asia. The challenge for importers is to ensure that they supply safe, properly labelled products.

There is pressure on the location of marine aquaculture facilities as many suitable locations are also desirable for tourism, shipping and water sports.

Fuel prices are also a concern within seafood companies with rising prices hitting freight costs. In a highly competitive environment it is difficult for the seafood industry to pass on these cost increases to their customers.

The vast bulk of aquaculture production is made up of a small number of species and there is no apparent reason why other species from among the several thousand that are exploited by capture fisheries could not eventually be raised economically within marine aquaculture. Awareness of the requirements of the

⁵³ Eurostat Yearbook 2004

⁵⁴ See the aquaculture appendix for values and tonnes.

⁵⁵ Intrafish, December 2004, p15

environment so as to secure a sustainable future must be at the fore of the considerations of the aquaculture industry, complementing the concerns of the consumer and society.

A continuing consolidation of the seafood industry is expected. Fragmentation often means inefficiency. Global consolidation is necessary as otherwise the largest producers (Asia) who control the raw product will control the market, leaving Europe and America at its mercy.

13. SEAFOOD PROCESSING

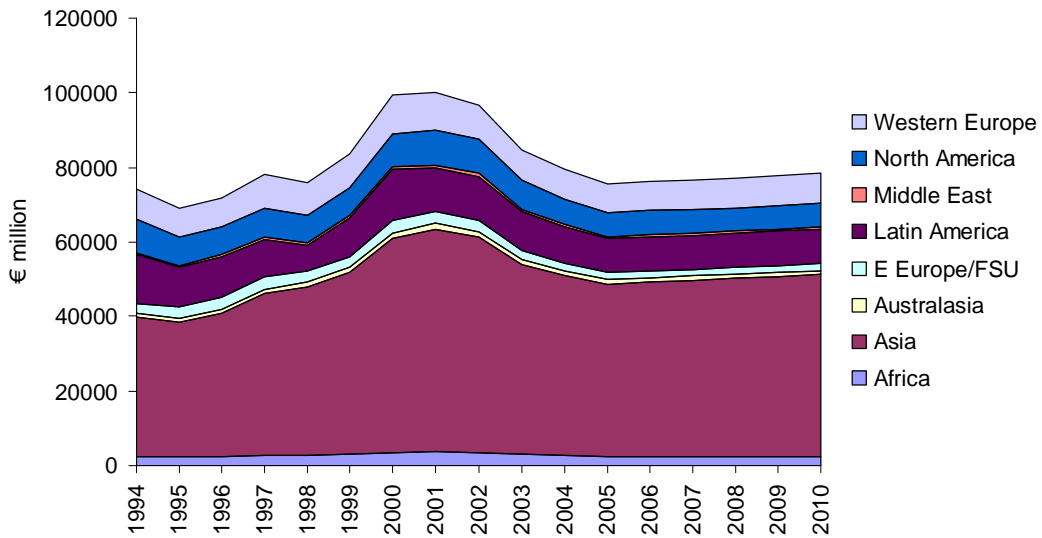


Figure 13-1: Seafood Processing – World Market

Source: Douglas-Westwood

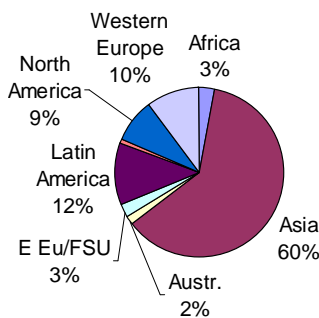


Figure 13-2: Seafood Processing – World Regions Segmentation 2005

Due to the high levels of production from both capture fishing and aquaculture, Asia also leads the seafood (fish & shellfish) processing sector.

Seafood Processing	2005	2010
World €M	75544	78644
Europe €M	7686	8285

Definition – Output value of processed seafood (fish and shellfish).

Methodology – Seafood processing revenues have been estimated by combining the marine aquaculture and fishing revenues for each country. Although seafood processing is not derived from these combined revenues, they do seem to mirror the value of processing approximately, from looking at a number of countries including Canada, Ireland and the UK. Obviously far more detailed analysis would have to be performed to ascertain individual countries’ processing market accurately. As a result some individual countries’ values may be inflated or deflated. Our estimates for are the value added to the unprocessed product.

13.1. Overview

Processing tends to add 100% to the overall value of the raw products of the capture fishing aquaculture sectors. A considerable export market exists for processed seafoods and high cost European producers such as Norway are greatly aided by establishment and development of a premium brand. Challenges for smaller producers include the need to develop and/or invest in automation and increase production to achieve both economy of scale, volumes and continuity of supply required by the major European supermarket chains.

Processing is a growing market, fuelled by a growing consumer appetite for ‘value-added seafood’ and by changing lifestyles. To add value to seafood the process may be simply filleting or adding a sauce and creating a ready meal. The processing industry is an important employer in European coastal communities.

13.2. European Market

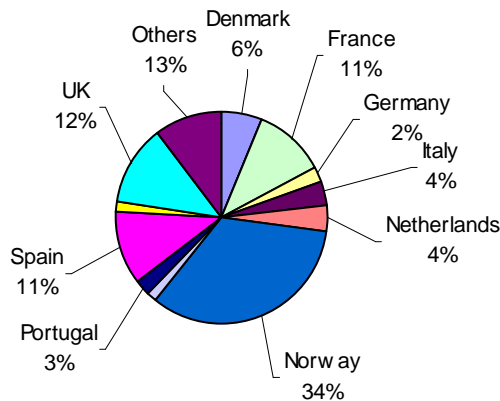


Figure 13-3: European Seafood Processing Sector Segmentation 2005

The value-added culture is not spreading in a consistent way across Europe. In most Mediterranean countries people still have the desire to have a whole fish on their plate.⁵⁶ Although, generally, value-added products are year by year taking a greater share especially within the chilled fish sector. From the available information, within the EU, the UK has the largest share of the processing sector, followed by Spain.⁵⁷

Consumers drive the market with a move towards ready meals and according to Intrafish there could be a gap in the market for value-added seafood snacks as well. The Dutch and Danish lead the processing market in ‘Packaging’ – prolonging shelf-life and ‘Automation’.

13.3. World Market

In the chart above the world processing market looks like it will experience a decline in revenues in the early part of the 21st century. This is a consequence of the weak dollar against the Euro. If the graph was plotted in dollars, it would show a steady growth. Asia holds the biggest proportion of the market, at over 60%, due in part to its large domestic seafood production.

Due to the major differences in labour costs, it is sometimes cheaper for European countries to export unprocessed products to the Far East for processing and re-import, rather than process at home.

13.4. Challenges

The combined factors of more women in full time employment, higher disposable incomes, sophistication of tastes and declining cooking skills mean value-added seafood sales have been increasing, creating more opportunities for the processing business. New species are also likely to be added to those used by processors. European processors will have to focus on the fresh/chilled market to remain profitable and compete with the frozen products from low cost countries further afield. This is good news for European processors, as chilled products are outselling frozen in some countries such as the UK.

Increased processing efficiency is required, to both reduce labour contents and extract more meat per fish, therefore increasing productivity.

The growth of the convenience sector offers opportunities for innovative ideas. This requires R&D spending in the areas of production, preparation (e.g. de-boning), processing and automation. These areas need to be developed in partnership with companies (applied research) with a commercially focused approach.

⁵⁶ Intrafish, ‘Value Added Seafood Trends’, November 11 2004.

⁵⁷ Eurostat

14. OFFSHORE OIL & GAS

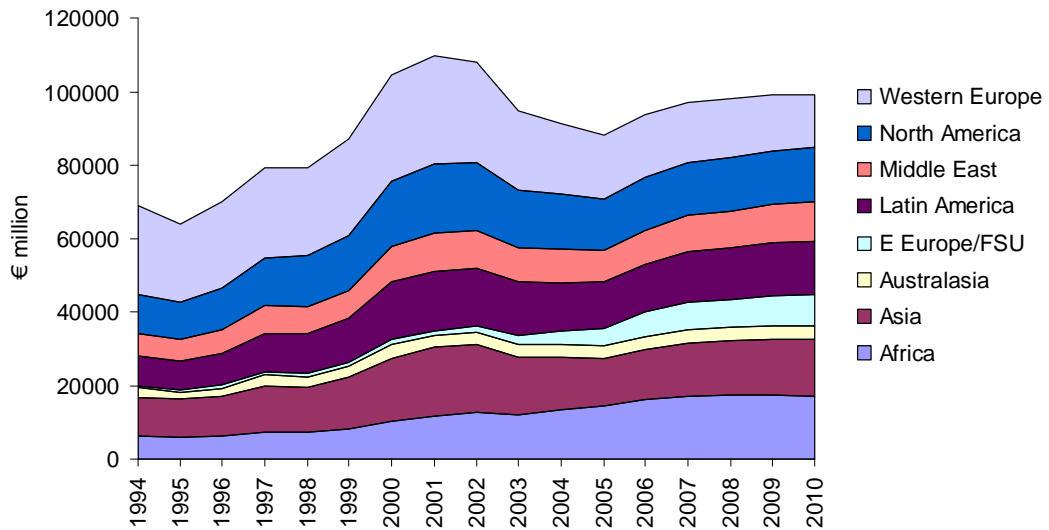


Figure 14-1: Offshore Oil & Gas – Global Expenditure

Source: Douglas-Westwood & EnergyFiles

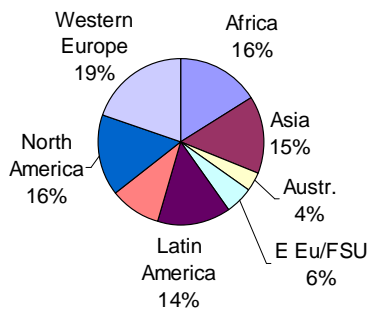


Figure 14-2: Offshore Oil & Gas – World Regions Segmentation 2005

Offshore oil & gas exploration & production expenditure is mainly distributed across five main regions. Strongest future growth will be from West Africa, whilst Europe face long-term decline.

Oil & Gas	2005	2010
World €M	88237	99057
Europe €M	17301	14392

Definition – Total capital and operational expenditure. (Not the value of the oil & gas which is considerably greater.)
Methodology – We take ‘Energyfiles’ data as used in *The World Offshore Oil & Gas Forecasts* published by Douglas-Westwood. These are based on an approach of estimating yearly production additions, whereby all elements of capital and operating expenditures are taken into account. Thus items such as exploratory activity, front end engineering, unscheduled maintenance work and unpredicted early production systems on new discoveries, together with hidden costs and other overheads are included.

14.1. Overview

Offshore oil & gas is probably the world’s largest marine industry in terms of the value of its output. Its input cost (total expenditure) in 2004 is likely to be €91bn. We expect this to grow to €99bn by 2009 and to be maintained at a similar level to 2012. Some 35% of global oil production and 27% of gas production is from offshore. Although only a small producer itself, Germany is a provider of certain items of technology.

The main market driver is the continuing growth in global energy demand of which oil & gas supplies some 62%. Most of this growth is coming from the developing economies.

Expenditure is divided into two main areas, capital expenditure (Capex) – the investment in offshore field development and operational expenditure (Opex) – the cost of maintaining and operating the fields.

The North Sea has been the region of greatest activity over the past 30 years. In 2005, Western Europe is expected to account for 20% of global offshore expenditure, but production is at peak and the region's share will decline to 15% by 2010.

Depletion of reserves shallow waters (<500 m water depth) worldwide is causing the oil majors to deep water regions of the world such as Africa, Brazil and deepwater Gulf of Mexico where major fields are still to be found. As shown in the table and chart, most future growth is forecast for these regions.

This change to deepwaters has resulted in the growing utilisation of floating production systems and subsea production technology at the expense of fixed platforms.

Germany, with few offshore fields is forecast to continue to form a small market unless there are some major discoveries; however, German companies supply technology to a number of key foreign markets.

The offshore oil & gas industry has a very large number of suppliers. One trade directory has 7,000 company entries offering some 3,200 categories of products and services.

14.2. Offshore Europe

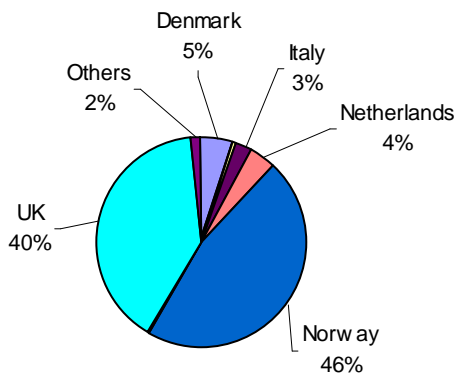


Figure 14-3: European Oil & Gas Sector Segmentation 2005

Two countries, Norway and the UK are forecast to account for 86% of European expenditure over the next five years.

After nearly 40 years of production Europe is a mature region and is now entering an irreversible long-term decline. In 1979, the UK had 14 offshore oil fields operating, producing an average of 112,000 barrels per day (b/d) by end 2003 numbers had increased to 157 and average production per field fallen to 13,000 b/d.

Although there could still be some significant discoveries, capital expenditure is already seeing decline, but operational expenditure will remain high for many years. With the oil majors exiting the North Sea for other regions, considerable opportunities remain for small oil companies and in this respect, the UK sector is seen as one of the world's most attractive 'plays'. There are many small undeveloped fields (up to 250 in the UK sector) and these offer opportunities for development by tie-backs of subsea wells to existing platforms and pipelines. In addition, there are many prospects for new companies to acquire existing 'brown fields' from the existing oil majors.

14.3. Offshore Activities

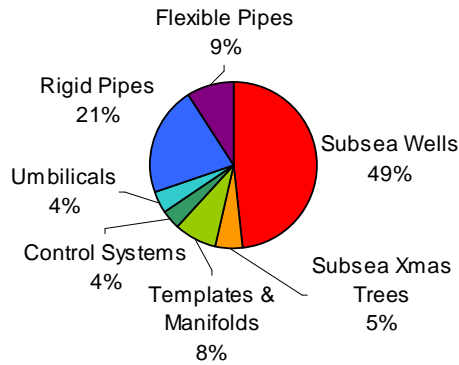
Initial exploration is mainly by the use of seismic surveys. Drilling is a major activity with about 1,000 exploration & appraisal wells drilled each year and more than 2,000 development wells creating a total annual expenditure exceeding \$37bn in 2004.

Drilling and completing wells can form 50% of the costs of developing an offshore field. The other major items are fixed and floating platforms and pipelines. Fixed platforms are still the main development method with an estimated 6,400 having been installed in the Gulf of Mexico to date (mainly very small ones). The North Sea has some 600, with a combined weight of 12 million tonnes.

As a region matures Capex declines and Opex dominates – this is becoming the case with the North Sea. Eventually, fields reach the end of their productive life and are decommissioned. Over 100 small platforms per annum are removed from the Gulf of Mexico. Due to its larger structures decommissioning will eventually become a major activity in the North Sea.

Figure 14-4: Subsea Field Development Costs

Source: Douglas-Westwood



Where economics do not permit dedicated platforms, fields are often developed by wells completed on the seabed and tied back to platforms. This is particularly the case for small fields and fields of all sizes in deepwater. In many instances, particularly in deepwater, subsea wells are tied back to floating production platforms.

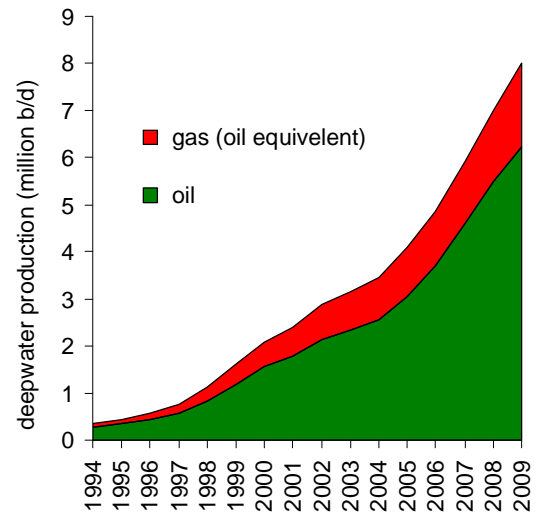
14.4. Deepwater

Figure 14-5: Deepwater Oil & Gas Production

Source: The World Offshore Oil & Gas Forecast

The growth of deepwater activity (>500m) is one of the most significant trends of recent years with the most important areas being Angola, Brazil, Nigeria and the US Gulf of Mexico – where it now accounts for 60% of total production. In 2004 deepwater oil production, about 2.6 million b/d, comprised 10% of global offshore production and deepwater gas production around 7%.

We expect deepwater production to grow from a present oil & gas equivalent of 3.4 million b/d, to 8 million b/d by 2008 and continue its growth beyond 2012.



14.5. Floating Production

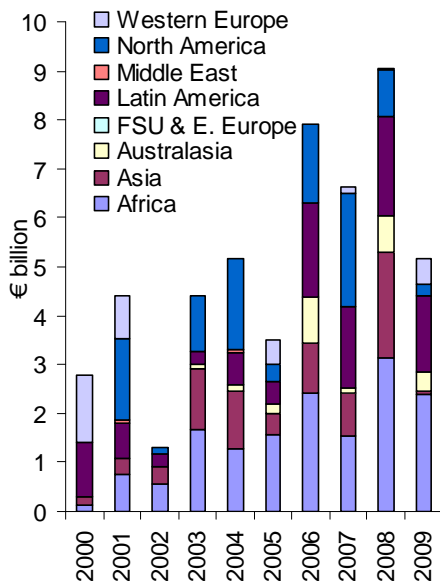


Figure 14-6: Floating Production Expenditure Forecast

Source: The World Floating Production Database

The development of deepwater fields has resulted in a strong growth in the use of floating production systems. The most common form is the FPSO, (floating production, storage and offloading system).

FPSOs are usually tanker conversions, with 137 deployed to end 2003. Other types include semi-submersibles (FPSS) and more custom structures such as Spars and TLPs (tension leg platforms).

We forecast a continued growth in use of all types of floating production systems. Although floaters are used in all water depths, most of this growth will be associated with deep waters.

14.6. Challenges

In common with other sectors, a common theme is that of reducing costs. Particular targets are the main expenditure sectors of drilling, production facilities and pipelines.

Deepwater operations – the record for deepwater production is currently some 2,316m but exploration is happening in greater than 3,000m water depth. Such great depths represent major challenges. Operations in great water depths considerably increases the time and therefore costs associated with drilling (a shallow water well can cost \$5 million – a deepwater one 4 to 20 times this). Installing heavy seabed hardware becomes a challenge as the weight of lowering cable rapidly exceeds the weight of the hardware multiplying the winch capacity required. Flowlines to deliver production to surface facilities need to be heavily insulated and/or heated and dynamic risers for floating production form a particular challenge.

Subsea processing – the output of an oil well is in reality a mixture of oil, gas and water and the latter increases over time. A major need is to extend the flow distances of unprocessed oil & gas by separating the product (on the seabed rather than on production platforms). An alternative is to develop pumping technology able to handle this multiphase mixture. Significant progress is being made in both these areas.

Floating production – a major new FPSO can cost in excess of €500 million and costs increase significantly in harsh environment areas (such as the Atlantic margins and off Northern Norway).

Mature fields – a growing proportion of the world's oil & gas, both onshore and offshore, is being produced from fields that are in decline. This proportion is currently nearing 50% and by 2012 could account for nearly 45,000 b/d.⁵⁸ Increasing production from mature fields represents a major business opportunity likely to attract considerable funding in future years.

The Reservoir – the ability to image and understand the reservoir is fundamental to the future success of the industry, both in terms of finding new reserves and managing the structure to achieve maximum economic recovery. Considerable progress has been made, but continuing investment is needed.

As discussed earlier, we expect to see a continuing growth in world offshore oil and gas production beyond the time frame of this report. However, production will decline significantly in the mature (shallow-water) regions and be balanced by that from deepwaters.

It is forecast that after 2010 all offshore oil production growth will come from deepwaters, compensating for declining output from shallow waters. From providing around 34% of total global oil production in 2004, offshore oil is forecast to be providing 39% by 2015.⁵⁹

From providing around 28% of total global marketed natural gas production in 2004, offshore gas is forecast to be providing 34% by 2015. By this time around 12% of gas will be coming from deepwaters compared to 7% in 2004.

Global offshore Capex is forecast to grow from €49bn in 2004 to €52bn in 2006 before slowly declining to €46bn by 2015, as opportunities slowly become exhausted. Opex is forecast to continue increasing from €40bn in 2004 to €52bn in 2015 as total output grows, especially from expensive deepwater environments.

The above is based on present costs, however, over the longer term, after around 2010 when a sustained increase in oil prices is likely as a global energy supply gap develops, it is very possible that real cost increases will materialise. Additional cost overheads within some parts of the offshore exploration and production industry could lead to expenditure growth, but without altering activity levels to a great extent.

Although Germany has only a very small home market, there is significant potential for supply of technology to international markets. One example of success is France which has developed a major oil & gas service industry without its own offshore production (but with the benefit of former state oil companies).

⁵⁸ 'Optimisation revitalises brownfields' E&P, pp12-17 December 2004.

⁵⁹ 'The World Offshore Oil & Gas Forecast', Douglas-Westwood Limited

15. MARINE RENEWABLE ENERGY

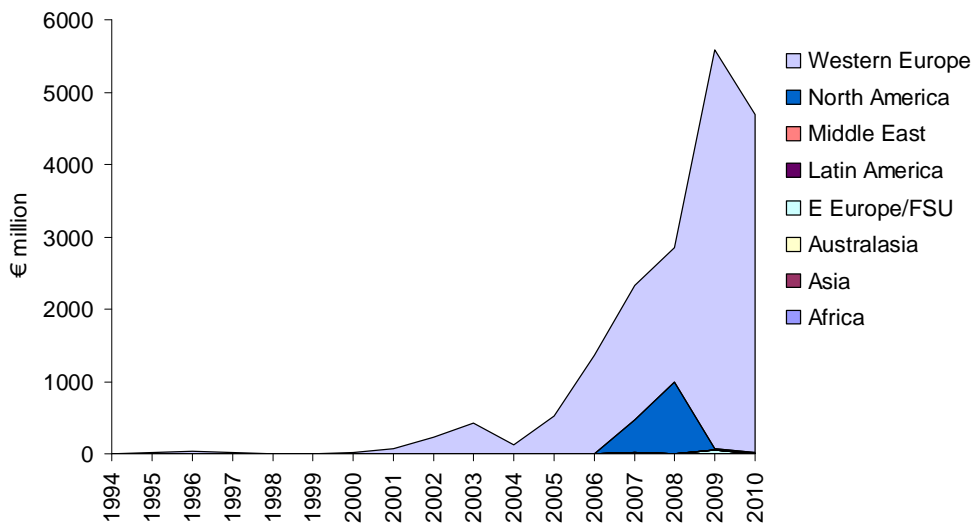


Figure 15-1: Marine Renewable Energy – Expenditure

Source: Douglas-Westwood

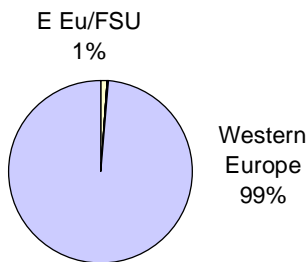


Figure 15-2: Renewable Energy – World Regions Segmentation 2005

Offshore renewable energy is a new business sector and the initial market growth will be in Western Europe.

Renewable Energy	2005	2010
World €M	514	4704
Europe €M	506	4689

Definition – Total capital expenditure on wind, wave and tidal current installations.

Methodology – Data is drawn from *The World Offshore Wind Database* and *The World Offshore Wave & Tidal Database*, both published by Douglas-Westwood. The databases list all existing installations and track future projects. Forecasts are based on our own views of when projects will become operational, and are therefore less optimistic than operators' own estimates.

15.1. Overview

Investment in offshore renewable energy is now growing strongly, but from a very small base. From €128 million capital investment in 2004, expenditure is expected to exceed €4.7bn by 2010, plus operating expenditure.

Some 85% of forecast expenditure in the 2005 to 2010 period is expected to be in Western Europe with North America forming the second largest segment at 12%.

The main market driver is the political response to global warming. The UK, for example, wants to generate 10% of its electricity from renewables by 2010 and 20% by 2020. The most obvious solution is to increase the use of windpower. However, the best European onshore locations are becoming used up, there are considerable local objections to the visual impact of wind turbines and the best (windiest) sites often have no nearby access to the main transmission grid.

The industry is therefore beginning to move offshore where turbines are out of sight and have better wind environment. There have been relatively few installations to date but major growth is forecast. We are at the beginnings of an important new industry.

Over the next five years, we forecast that Western Europe will account for 88% of global expenditure.

The other developing technologies are wave and tidal current power. These are at a much earlier stage of commercial take-up and are forecast to form only 1% of the capital investment in offshore renewable energy by 2010. However, they have considerable long-term potential.

15.2. Offshore Windpower

There are 17 operational offshore wind farms worldwide. The 324 installed turbines in these projects provide a total of 605 MW. The most recent project is the 60 MW Scroby Sands wind farm off the UK. A total of 2,258 turbines are forecast to be installed between 2005 and 2010, a total of 7,500 MW.

The first offshore wind turbines were installed at Vindeby off the Danish island of Lolland in 1991, but significant activity did not begin until 2001. Once the associated industry was deemed established, the Danish government's economic support for offshore windfarms was withdrawn and new installations virtually ceased.

By 2008, it is likely that the UK will be the world's largest market, with Germany taking the lead in 2009. The USA may also begin to develop into a significant market over the period.

The first ten years saw small projects being built in very shallow-water, near shore locations. These wind farms, in most cases, used onshore turbine models with slight adaptations. These 'demonstration' projects have paved the way for the more recent projects that are much larger.

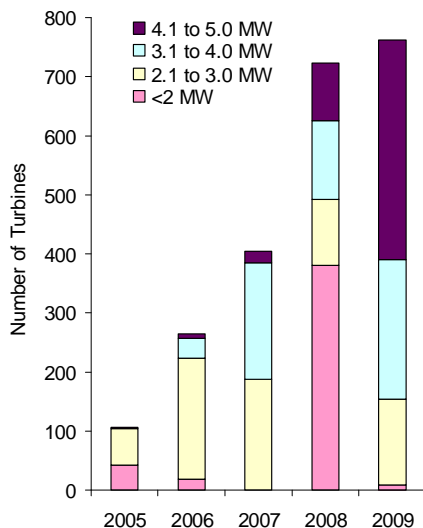


Figure 15-3: Offshore Wind Turbine Size

Source: Douglas-Westwood

Increasing offshore wind turbine size is a key issue – fewer turbines mean lower costs.

The Arklow Banks wind farm off Ireland has seven 3.6 MW turbines operating, presently the largest in the world. Prototype 4 MW turbines are expected in 2005/6, 5 MW from 2007 and by 2009 these will be the norm. Above this size the technology becomes significantly more costly and difficult to implement (The blades on a 5 MW turbine span over 120 metres.)

At the same time distances from the shore and water depth are increasing. The deepest installation to date is Samsø off Denmark, with ten 2.3 MW turbines in an average of 19m water depth.

The largest project currently operational is the 160 MW Horns Rev wind farm off Denmark. In ten years time, 1 GW will be a standard size. The largest project to be announced is some 75 km offshore Germany in 40m of water, with a target capacity of 17,500 MW.

At these locations installation work becomes significantly more difficult. Standard monopile foundations are not ideally suited to large turbines in deeper waters and tripods or jackets are proposed. Installation vessels used have 'legs' that lower to the seabed to give stability, but these are designed for shallow water.

15.3. Wave & Tidal Power

In comparison to the more established offshore wind sector, both wave and tidal energies are embryonic sectors and barely register economically because of the low level of activity. The small number of announced projects limits the outlook for these industries.

To give an example, in 2009, DWL expect over 30,000 MW of offshore windpower installations worldwide and only 15 MW of wave and tidal installations.

Nevertheless, despite being overshadowed by the offshore wind sector, wave and tidal energy offer much long-term potential and the next five years will see a number of technologies reach commercial application and be installed in multiple-unit configurations. In this respect these developing industries can be seen as being at a similar stage to offshore wind a little over a decade ago. With sufficient encouragement, sizeable wave and tidal farms will be in place by the next decade.

‘Wave power’ is defined as electricity produced by devices utilising the direct and indirect action and movement of waves in the horizontal and/or vertical planes. This includes devices located offshore, nearshore and on the shoreline. Operating examples include the Limpet shoreline device installed in 2000 on the island of Islay off Scotland’s west coast and the Wave Dragon off Denmark which was the first offshore grid-connected wave energy device when it was commissioned early in 2003.

‘Tidal’ is electricity produced as a direct consequence of the large-scale movement of bodies of water due to the ebb and flow of the tides.

‘Tidal Current Stream’ is electricity produced through the regular flow of currents. Whilst tidal action may affect the direction and intensity of a current stream its motion is not directly dependent upon it. Operating examples include Marine Current Turbine’s Seaflow project off the UK, which was the first tidal current stream turbine to come online.

15.4. Challenges

Energy Type	€/kWh
Onshore Wind	5.3
Offshore Wind	7.9
Wave/Tidal	9.5
Nuclear Fission	3.3
Coal	3.6-4.6
Gas	3.2-4.5

Table 15-1: Energy Generation Costs

Source: The Royal Academy of Engineers March 2004

The major challenge faced by offshore renewable energy is in reducing its costs to be comparable with ‘conventional’ power generation from gas and coal. (The costs in the table include: capital cost, fuel and operational cost, transmission and storage of gas).

Standby generation is also needed for onshore/offshore wind for periods of low wind and if included this would add approx 1.7 €/kWh).

The introduction of carbon emission allowances would close the gap between traditional fuels sources and offshore renewables. For the UK, a figure of approximately €2.9/kWh is possible. Studies by OXERA, for the UK government’ Renewables Innovation Review, show that prices for onshore wind would drop to €3.9kWh by 2010.

At present, gas fuels most of the new power generation capacity installed in Western Europe and many other countries in the past 20 years. The UK (and the USA) are facing gas supply shortages and although new supplies can be sourced these will be at a higher cost.

In addition, by the middle of the next decade it is likely that shortages of oil, leading to real price increases, will boost demand for gas and result in further price increases. We believe that the overall result of this will be to somewhat improve the competitive position of renewable energy.

There is also potential for the drive for development of renewable energy resources to change progressively from green politics to security of supply.

Research & Development – The emergence of new technologies are dramatically increasing the viability of accessing the huge potential offshore renewable energy resource. The industry is constantly searching for better and more efficient solutions for energy generation and as new technology emerges it is put into practice almost immediately. The increasing size of wind turbines are an example of this. (To supply and install, turbines account for 51% of total project costs.)

None of the existing offshore renewable energy technologies are viewed as ideal and all can all be improved in some way, by increasing capacity, lifespan, reliability, etc., and perhaps most importantly of all, improving efficiency by reducing costs.

There is major potential for research, technology development and licensing in most aspects of offshore renewable energy. This includes turbines, foundations, cabling/power transmission and wave and tidal current power.

An associated, but often overlooked area is that of power storage in order to provide back-up for offshore (and onshore) windpower.

16. SHIPBUILDING

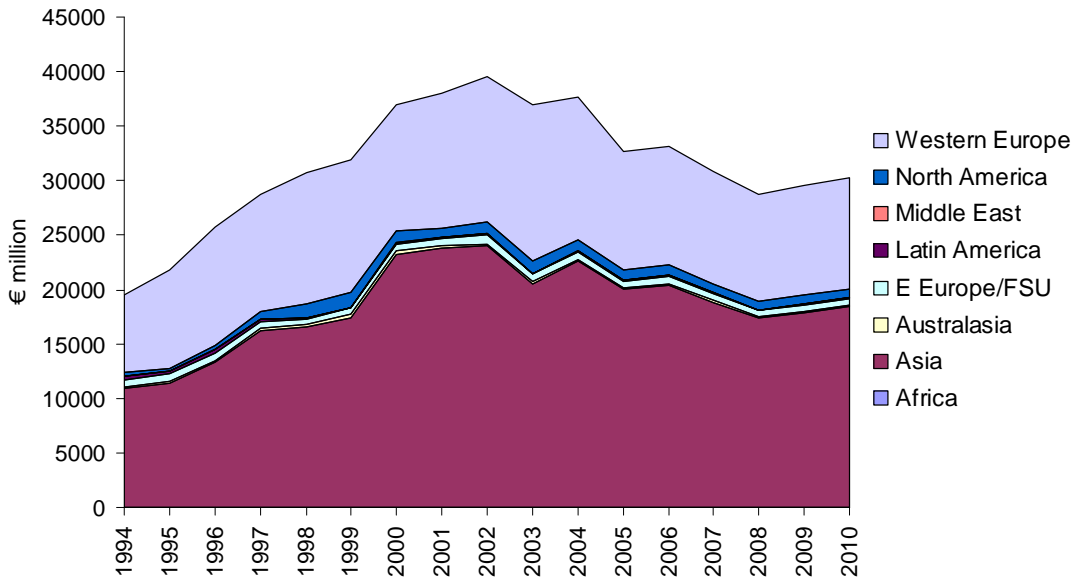


Figure 16-1: Shipbuilding – World Market

Source: Douglas-Westwood

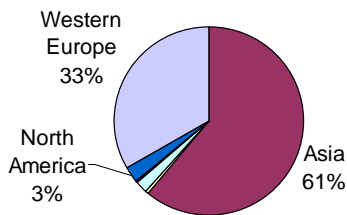


Figure 16-2: Shipbuilding – World Regions Segmentation 2005

Demand is shipping-driven and current owner confidence has boosted orders and shipyards are full. This sector is experiencing a peak which will be followed by a return to long-term growth trends. The sector is dominated by SE Asia, but Europe has a major share based on more specialised vessels. (The market decline in Euros shown above is not so significant in US dollars which are the currency of the market.)

Shipbuilding	2005	2010
World €M	32744	30272
Europe €M	13143	10120

Definition – Value of ships based on all vessels =>100GRT as listed by Lloyds-Fairplay.

Methodology – The Lloyds-Fairplay database was used to determine ship numbers, GT & CGT. Then referenced OECD tonnages and \$/CGT figures for 2003. Individual European shipbuilding values were drawn from AWES figures. Forecasts are based on views of relationships between world trade, shipping activity and vessel orders.

16.1. Overview

For over a decade the prices of newbuilds has been on a downward trend. The 1990- based US\$ index had fallen by 50%, mainly due to chronic overcapacity resulting from government subsidies, often attacked by the EU but to little effect.⁶⁰

The world shipbuilding industry is currently enjoying a strong upturn due to the major growth in demand for shipping discussed earlier. World economic growth is buoyant and it is expected to remain strong in the medium term boosted by the very strong growth of the Chinese economy and to a lesser extent that of other developing economies. World seaborne trade has increased with exports of containerised goods and

⁶⁰ Report from the Commission to the Council on the Situation in World Shipbuilding. Commission of the European Communities, 2003.

imports of commodities to feed these economies such as oil & steel. The commercial shipping industry has become more profitable than at any time during the previous decade and ship-owner confidence has grown. The overall result has been a surge of orders for vessels and yards currently have full order books, newbuild tanker prices are up by 40% and average delivery time extended from two to three years.⁶¹ We expect record years ahead and in this current cycle shipbuilding output to reach 26 billion CGT in 2006 compared to 20 billion in 2000.

It is unlikely that such high economic growth rates can continue for long. Following the peak in shipbuilding activity in 2006, in 2007-8 we expect a return to more normal activity levels as the new tonnage is absorbed by the market. It is of note that SE Asian shipyards are now reflecting this view by not further adding to capacity. However, shipbuilders profits have been hit by a combination of a large rise in steel prices and a fall in the US\$. A result is that South Korean yards are reported to be targeting fewer orders in 2005.⁶²

From some US\$34bn in 2000, we expect the total value of shipbuilding output to peak at around US\$46bn in 2004, and then fall to US\$39bn in 2008 before returning to its underlying long-term growth trend.

The industry has over the longer term produced an average of some 1,800 vessels per annum. Notable changes in the market have included a trend towards larger vessels, especially container vessels and tankers. We believe that this will continue but will not appreciably affect the *average* size of new vessels constructed during our forecast period.

Over the years there has been a growth in average vessel size and we may well see 10,000+ TEU container vessels operating before 2008 but their numbers will be small. (It is reported that Cosco have ordered four off 346m long, 25.8 kt., 10,000 TEU vessels for \$506 million.⁶³)

16.2. The World Market

The European Commission notes that “historically, the industry has suffered from the absence of global rules and a tendency of (state-supported) over-investment due to the fact that shipyards purchase a wide range of technologies, employ a significant number of workers and generate foreign currency income”.⁶⁴

The major development in global shipbuilding since the Second World War has been the growth of SE Asia as the main shipbuilding region and the decline of Europe. This originally began with the post-war rise of Japan and then South Korea. (In 2002 the European Commission reported its efforts to stem the effects of “certain business practices by Korean yards” concluding that their “prices do not cover the full costs of production”).⁶⁵

During this period, Korea entered new market segments and boosted demand in existing ones by aggressively cutting prices despite its increasing costs.

Japan undertook massive restructuring by bringing together yards into umbrella groups and by retaining the major share of its large home market – Japanese owners were noted for being very reluctant to place orders with foreign yards.

The other and more recent change is the development of China into a major shipbuilding nation. This is based on low labour costs and despite past organisational problems and difficulties of access to technology having been restraining factors, these are rapidly being overcome. The EU’s annual report on shipbuilding notes the growth in China’s share of the world market growing from 7% in 2000 to 13% in 2002.

⁶¹ *Lloyd’s List Annual Review* 30 Dec 04

⁶² *Lloyd’s List* 5 Jan 05, p1

⁶³ *Lloyds List* 25 Jan 05

⁶⁴ <http://europa.eu.int/comm/enterprise/maritime/>

⁶⁵ ‘*Sixth Report from the Commission to the Council on the Situation in World Shipbuilding*’ Commission of the European Communities, 13 Nov 2002.

Today the region dominates the delivery of tankers, bulk carriers and other large vessels that can be efficiently produced by 'industrial' shipbuilding techniques.

Europe has lost market share in terms of total tonnage due to the decline in orders for 'standard' ships which can be produced more cheaply in SE Asia. However, it has retained the higher value-added lower volume parts of the market for more specialised vessels such as cruise ships, smaller tankers and those used by the offshore oil & gas industry. These are in general of higher value than ships built in Asia – for example, OECD statistics suggest an average of \$2,548 CGT in Europe, compared with \$1,355 in Asia.

Shipbuilding like shipping is a highly cyclical industry. At the time of its sixth report on the situation in world shipbuilding in late 2002, the European Commission had noted the impact of past over-ordering following a period of almost continuous growth from 1995 to 2000. The uncertainties in the world economy following the events of 11 September 2001 resulted in a fall in confidence and a major reduction in orders – 60% down in mid 2002 at 3 million CGT, compared with a quarterly peak of the 7.5 million CGT in mid 2000.

In the EU the situation was even worse with a decline of 80% in new orders. 9/11 also resulted in a major fall in orders for cruise ships, a European specialist sector. Between 2000 and 2002 the EU share of the world shipbuilding market fell from 19% to 7% and the Chinese share grew from 7% to 13%.

In 2002 the EU authorised direct aid of 6% to shipyards as a Temporary Defensive Mechanism.

The present up-cycle was triggered by the growth of the Chinese economy. Overall world economic activity has also grown, the cruise industry has recovered and shipowners' profits have been high generating cash for re-investment in new tonnage producing a surge in ship orders in 2003 and 2004.

A decline in total orders in 2004 and the following years onwards (compared to 2003) is also expected by AES in its 2003-2004 annual report.

The peak is now in sight and we expect the Chinese economy to cool somewhat and new orders to decline in 2005 and 2006 before a return to the underlying slow long term growth trend. A major uncertainty in the period ahead is the reaction of the SE Asian yards to a return to lower order levels.

However, a further situation that could have impact is that 1,119 single hull tankers are, in theory, due to be phased out by the end of 2005.⁶⁶

16.3. European Market

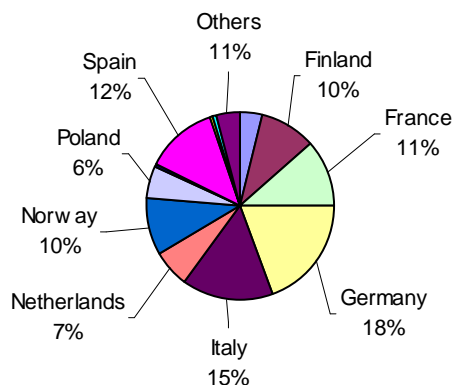


Figure 16-3: European Shipbuilding Sector Segmentation 2005

Shipbuilding is an important and strategic industry in a number of EU Member States. Shipyards often play a significant role in regional industrial infrastructure and, with regard to military shipbuilding, involve national security interests.

The European shipbuilding industry is the global leader in the construction of complex vessels such as cruise ships, ferries, mega-yachts and dredgers. It also has a strong position in the building of submarines and other naval vessels. Equally, the European marine equipment industry is a world leader for a

⁶⁶ *Destination Unknown*. European single hull tankers report. Greenpeace 2003.

wide range of products, from large diesel engines to marine electronics. The Community of European Shipyards Associations (CESA)⁶⁷ states that:

- The European shipbuilding industry holds approx. 20% of the world shipbuilding capacity.
- Member Shipyards provide around 130,000 high qualification jobs through direct employment and generate more than three times as many the in marine equipment and service industries in Europe.
- The annual turnover of shipyards represented by CESA in 2003 was €14.4 billion in merchant shipbuilding and 2.1 billion € in ship repairing. Exports accounts for roughly 70% of the total turnover.
- As key drivers of maritime excellence, European yards invest on average approx. 10% of their turnover on research, development and innovation.

In addition to shipbuilding, European ship repair and conversion was a business valued by the AWES at €2.2bn in 2003. Germany is the largest player with a share of €553 million followed by the UK with €400 million.

Over the period 1979 to 2003 (for which official statistics are available):

- Countries merchant shipbuilding turnover grew by 30.5% (to €14.4bn)
- Deliveries increased by 20% to 5 million CGT
- Market share decreased slightly to 20% in 2003.

Table 16-1: Western European Shipbuilding Turnover (€ million)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Denmark	729	764	867	804	641	754	538	631	484	504
Finland	380	788	1302	1063	875	833	908	1023	1171	950
France	327	835	769	589	626	819	1098	1450	1110	1850
Germany	2396	2701	2741	2533	2570	2084	2329	3011	3416	2780
Italy	1289	778	1630	1455	2570	2604	1829	1406	1815	2208
Netherlands	583	778	847	931	997	1168	1163	967	950	725
Norway	571	684	986	1131	1274	1577	1115	1626	1654	2152
Poland	-	677	707	916	915	925	897	784	759	470
Portugal	33	43	56	57	0	10	96	70	6	72
Spain	468	664	541	626	1057	994	1150	954	934	1927
Sweden	0	0	60	-	-	-	-	-	-	-
UK	211	210	278	520	278	140	180	89	81	50
Others	122	40	0	0	0	0	257	186	720	640
Total	7109	8962	10784	10625	11803	11908	11560	12197	13100	14328

Source: various AWES annual reports

CESA is due to produce a new forecast of shipbuilding demand in summer 2005. (Like many other forecasts, the previous AWES one in 2001 did not anticipate the remarkable growth of the Chinese economy and the resulting current boom in shipbuilding.) The new report is likely to be produced in consultation with the shipbuilding associations of China, Korea and Japan.

16.4. Challenges

Fuel price increases have resulted in growing pressures to reduce vessel operating costs and the major technical challenge is to radically improve propulsion efficiency. Engine emission reduction is also a significant challenge.

⁶⁷ AWES Annual Report 2003-2004. The organisation was previously called the Association of Western European Shipbuilders & Shiprepairers

The long-term market is fundamentally a function of the growth in world seaborne trade, the underlying driver of shipping demand, which fuels owner confidence and results in more shipping orders.

In recent years there has been an increase in the size of vessels but this may reach its practical limit as a function of ports capacity.

Of increasing significance could be the growing desire in Europe, and to a lesser extent the USA, to transfer road freight to short sea shipping and this could result in an increase in orders for smaller vessels.

17. MARINE EQUIPMENT

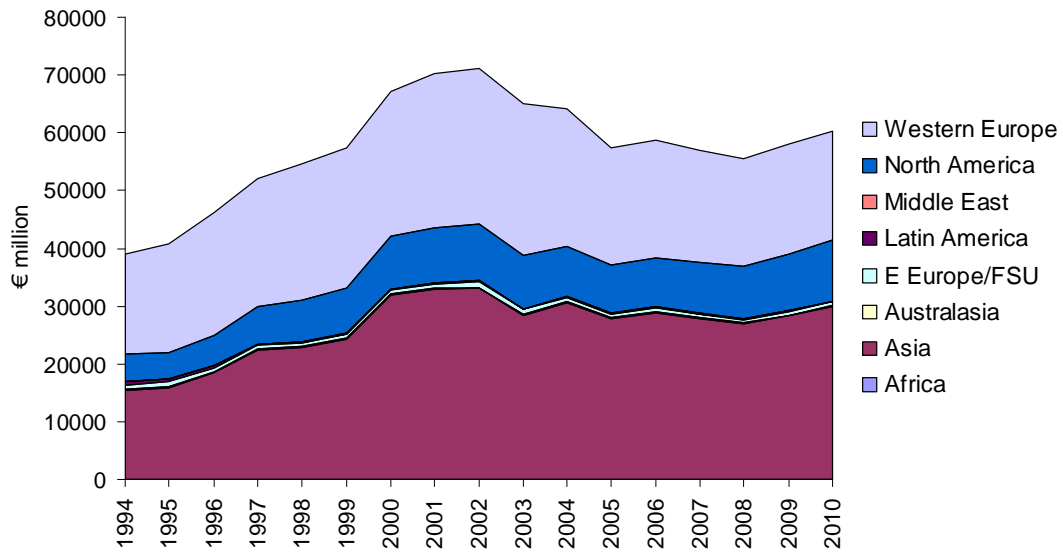
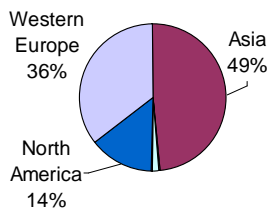


Figure 17-1: Marine Equipment – World Market

Source: Douglas-Westwood

Figure 17-2: Marine Equipment – Regional Segmentation 2005



The geographic segmentation of the marine equipment market is similar to the commercial shipbuilding and naval industries which forms the client base for the sector. However, due to the increasing after-sales service content, the geographic segmentation of the future market may be increasingly influenced by the location of commercial shipowners.

Marine Equipment	2005	2010
World €M	57474	60346
Europe €M	20504	18916

Definition – Equipment used in commercial and naval ships.

Methodology – We have determined the average proportion of shipbuilding costs accounted for by marine equipment as 57% and assumed the equipment content in naval vessels as 70%. In addition there are after sales service costs at 22%. These are applied to our valuation of the present and future commercial and naval shipbuilding markets.

17.1. Overview

We value the world market for marine equipment in the shipbuilding sectors in 2005 at €57 billion. Marine equipment is mainly comprised of shipbuilding capital items such as propulsion systems & machinery.

The sector has three major activities:

- Supply of equipment used in commercial ships
- Supply of equipment used in naval ships
- After-sales service to both sectors.

The marine equipment sector will grow as a function of activity in the two ‘customer sectors’ of commercial and naval shipbuilding. Due to the steadily increasing numbers of total ships after-sales service will grow at a greater rate.

In total there are some 5,000 to 6,000 suppliers of ‘marine equipment’ listed worldwide. However, a relatively small number of companies such as the major German and Japanese engine makers account for a disproportionately large share of the total market.

There is growing technology content in all sectors and many high-tech sub-sectors ranging from software, to control systems, to corrosion prevention. (Germany has a leading position in sonars and bridge systems.) It is within these specialised sectors that the main opportunities for SMEs exist.

17.2. What Constitutes ‘Marine Equipment’?

One of the problems in valuing this sector is the definition of what constitutes marine equipment and this will vary from country to country. In some countries such as Germany supply of equipment to shipbuilding dominates its marine equipment industry, in others there is a large oil & gas industry content.

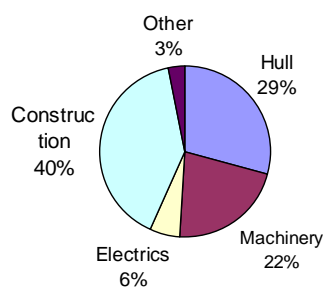
The definition of ‘marine equipment’ that applies to German industry and agreed with WTSH is the equipment used in commercial and naval shipbuilding. According to VDMA “the world market for maritime equipment including after-sales business is worth approx €65 billion annually” (and to German suppliers €8.3 billion in 2003).⁶⁸ (The €65 billion figure is the same as generated by our own estimates.)

In addition to hardware supply there is after-sales service which according to VDMA accounts for 22% of German marine equipment suppliers’ total revenues. (In the case of some engine makers it is even more – service accounts for 40% of Wärtsilä’s net sales!).

Many other smaller sectors such as offshore renewable energy could also be included as ‘marine equipment’; however, these are much smaller and would not make a significant difference to the totals. The only other major sector is oil & gas equipment. This is important for some countries but Germany does not have a major market share. Therefore equipment included in these other sectors is excluded from our valuation of the market.

17.3. Commercial Shipbuilding Marine Equipment

Figure 17-3: A Typical Merchant Ship Cost Segmentation



It is common for marine equipment to be valued as 60-75% of the cost of a ship, but this varies considerably by ship type.

The chart alongside shows the costs of a ship built in a German yard in 2004. If the hull, machinery and electrics are included then the ‘marine equipment’ total is 56.7%. In our estimates we use an average of 57% and apply this to the estimates of world shipbuilding expenditure.

⁶⁸ The source of these values is a speech by Mr John M. Young, Chairman of the Management Board of ATLAS ELEKTRONIK GmbH and President of the European Marine Equipment Council (EMEC). The term “maritime equipment” is not defined so there is no definition as what specific hardware and/or services are included in these values. We have asked EMEC to provide us with the basis of these estimates.

17.4. Naval Shipbuilding Marine Equipment

It is difficult to obtain a breakdown of the equipment content of naval shipbuilding. However, considering the very large 'systems' content of naval vessels it is reasonable to assume that the use of marine equipment is greater than with commercial vessels. We therefore assume 70% marine equipment content.

The largest market growth is expected to be in Asia which is forecast to see a considerable increase in naval expenditure over the period.

17.5. World Market

On this definition we expect the market to be €57 billion in 2005, and then to decline somewhat due to a forecast fall in civil shipbuilding orders before resuming growth from 2008. Much depends on the near-term growth of the main driver for both civil and shipbuilding – the SE Asian economies.

A factor which may tend to boost the market is growth in after-sales expenditure. This is likely due to increase due to three reasons: the very large numbers of aging vessels (greater than 80,000 are registered and this number grows each year), the increasing technical content of newbuild ship's equipment, and the pressures to reduce manning costs.

It is difficult to give a precise segmentation of regional markets due to the secrecy surrounding naval expenditure which we estimate makes up about half of the total market.

17.6. European Market

Europe is a major provider of marine equipment, particularly of high technology. In shipbuilding this ranges from electronic charting and integrated bridge systems to advanced marine engine and propulsion systems.

In 2000, Europe was estimated to satisfy 37% of the world demand for shipbuilding sector marine equipment (and at that stage it had a 16% of the world shipbuilding market, ranking third after Korea and Japan).⁶⁹ In other words, Europe is a very successful exporter of marine equipment. In 1997 the leading European suppliers of marine equipment were Germany 22%, UK 19% and Norway 15%.

Our own estimate (using German definitions of marine equipment) is that Europe at €20 billion constitutes 34% of the market in 2005.

We cannot give a segmentation of the European market by country due to the absence of published data on individual countries naval shipbuilding expenditure.

17.7. Challenges

See individual sectors.

⁶⁹ 3rd Report from the European Commission to the Council on the Situation in World Shipbuilding 2000.

18. EDUCATION & TRAINING

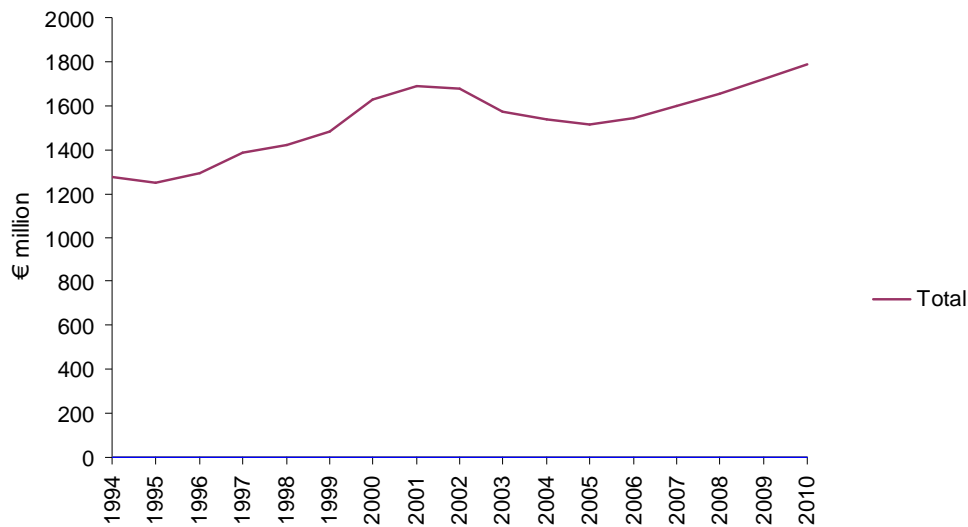


Figure 18-1: Education & Training – World Market

Source: Douglas-Westwood

Note: Education and training is a complex sector that does not readily segment into regional or national markets – see text below.

Education & Training	2005	2010
World €M	1514	1790
Europe €M	?	?

Definition – Marine-related education and training of personnel employed in the marine sectors.

Methodology – For the two main sectors (shipping and offshore) we have developed estimates of numbers of personnel and annual average training costs. Forecasts are based on taking the growth estimates for the two main sectors and personnel replacement levels. Higher education is based on numbers of establishments and course costs. As in many countries the education and training sectors are greatly subsidised, the totals we give may not fully represent the total costs to countries.

18.1. Overview

Education & Training has three primary activities: seafarer training, offshore worker training and higher education (universities).

Seafarer training – 400,000 officers and 825,000 ratings are employed worldwide with 60% of the latter being from the Asia Pacific region. There has been a 27% oversupply of ratings although there are doubts about the extent to which large numbers of these ratings are qualified for international service.⁷⁰

The majority of ratings are recruited from developing countries, especially the Far East. The Philippines alone provides almost 20% of the global maritime workforce. The Philippines is the largest supplier of seafarers with some 180,000 or 28.5% of the total maritime population of 632,000 are on board vessels worldwide. Russia is second with 7.3%.

But of the more than 500,000 registered Filipino seafarers, enough to man most of the vessels afloat around the world, more than 300,000 are unemployed. The result is that from 19.8% of Filipino seafarers deployed in 1995, only 3.4% were on board between 2000 and 2001.⁷¹

⁷⁰ [http://www.marisec.org/resources/2000Manpowerupdate .htm](http://www.marisec.org/resources/2000Manpowerupdate.htm)

⁷¹ Philippine Overseas Employment Administration

In 2000, there were 121 maritime schools in the country. But in 2004 the number was down to 76, twenty of which will be phased-out in the next two years, after their last students have graduated.

Other countries are also adding training capacity – South Africa opened a 150 student training academy in 2003 offering two three year courses. Amongst training tools are bridge and engine room simulators.

China and India are also significant maritime labour supply nations. Other major labour supply countries include Greece, Japan, Norway, Russia and the United Kingdom.

There is regarded to be a 4% undersupply of officers which is expected to rise to 12% by 2010. The OECD countries remain the most important source for officers, but growing numbers of officers are now recruited from the Far East and Eastern Europe and it is expected that this trend will accelerate as the ageing OECD officer group retires. The Barber International crewing company are reported as stating the situation could get much worse than expected due to the surge in newbuilding orders.

This is a widely recognised problem. In Germany, the Federation appropriated some €40 million in subsidies. These subsidies will be used for wage-related ancillary costs of seamen from Germany, as well as from the rest of the EU, employed on board German merchant ships in a first 15-month programme running until the end of 2002. In another move to promote seafarer training, the financial contribution was increased to €30,000 per trainee – this incorporates a financial commitment on the part of the Association of German Shipowners.⁷²

In the UK, cadet recruitment has been falling, from 1,200 in 1996 to 620 in 2003-4. Although the tonnage tax which has been very successful in other respects (ships in the scheme increased from 213 in 2001 to 745 in 2004 – half under UK flag) it has not resulted in increased employment of UK officers whose share fell from 70% of all officers employed on UK ships in 2001 to 40% in 2003-4. During the past 18 months more than 1,100 officers are reported as having been made redundant by shipping companies.⁷³

Seafarer training typically costs \$5-20K and officer \$40K. Refresher and ongoing training, such as fire-fighting or sea survival, are an additional training cost.

We estimate that over 2005-9 a total of 177,000 personnel will need training at 418 ‘maritime schools’ listed worldwide.

Offshore workers undergo safety training on a four year cycle. With an estimated 80,000 workers worldwide, some 20,000 are trained per annum. Safety training facilities are established in most of the world’s significant offshore oil & gas operating areas.

Safety training has been provided by the industry for many years, with the highest standards emanating from the North Sea due to its more demanding offshore environment than the Gulf of Mexico and the extensive use of helicopters from crew transfers. The need for even higher standards of safety and training was brought into focus following the Piper Alpha tragedy.

In addition to normal fire and first aid training, helicopter evacuation training has long been a requirement for North Sea workers and is conducted in specially equipped tanks. The introduction of free-fall lifeboats also introduced another requirement.

North Sea service providers, mainly based in the UK and Norway, have also developed into international markets.

Higher education establishments offering marine courses total at least 241 worldwide. However, it is difficult to estimate the total associated expenditure in this area as total operating costs of universities

⁷² *OECD Maritime Transport Committee - Annual Report 2001*

⁷³ *The NUMAST View, Parliamentary Maritime Review, No 50, 2005*

often greatly exceed fees charged. In addition, it is difficult to clearly separate the education element of universities' activities from research activities.

In 1997 it was estimated that more than 100 Higher Education Establishments in the UK offered courses with a significant marine content. Around 600 academic staff are involved in teaching 6,000 students. In 2004, we would expect these numbers to be much reduced, however, there is no data readily available to confirm this view.

All education and training has a strategic role in 'marketing' the supplier country and its technology to foreign students.

18.2. Regional & National Markets

It is not practical to consider this sector in the form of regional or national markets number of reasons:

Seafarers – personnel are recruited on a worldwide basis. As discussed above, the majority of ships' crews are sourced from countries such as the Philippines and the Indian sub-continent and officers from the developed countries (historically Europe). Training tends to be provided in home countries, so the 'market' is a function of the origin of the recruit.

Offshore personnel – these tend to train in the local market.

Higher Education – this is a mixture of local and international education.

19. RESEARCH & DEVELOPMENT

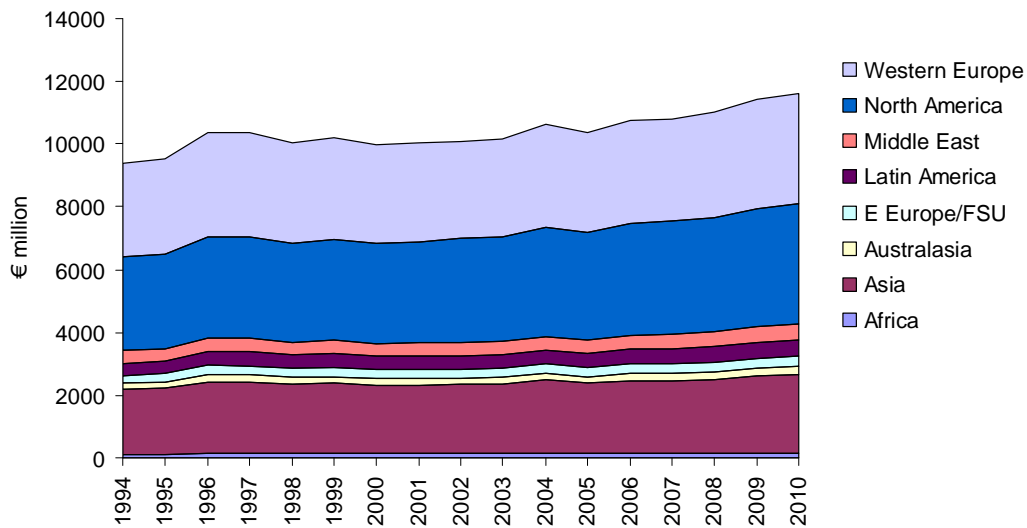


Figure 19-1: R&D – World Market

Source: Douglas-Westwood

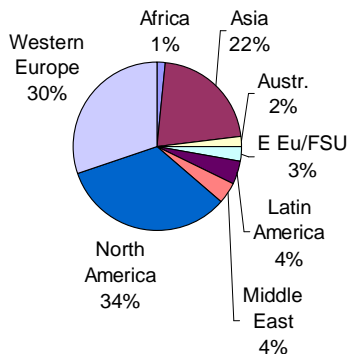


Figure 19-2: R&D – World Regions Segmentation 2005

We estimate that expenditure on marine research & development will exceed €10bn in 2005. The main areas of activity are Asia, the USA and Europe.

Research & Development	2005	2010
World €M	10346	11624
Europe €M	3136	3522

Definition – Expenditure on academic and commercial R&D.

Methodology – The main expenditure sectors are shipbuilding, oil & gas, other marine industries and government (mainly academic). The shipbuilding industry in Europe reports spending 10% of its revenues on R&D – however, we are concerned about their definitions so we use 5% and forecast based on future revenues. For oil & gas we use the mid point of figures produced separately by McKinsey and Shell and forecast based on our views of future industry expenditure. Other industries we total at €1bn. Non-military government expenditure is based on scaling up known US figures.

19.1. Overview

Research & Development has three main sub-sectors; the industrial ones of shipbuilding, oil & gas and others, and government (mainly academic). This sector is again difficult to segment into national and regional sectors as organisations expenditure often spans national boundaries; for example, an oil company may invest in R&D in Europe which is for projects in Africa, North America and South America.

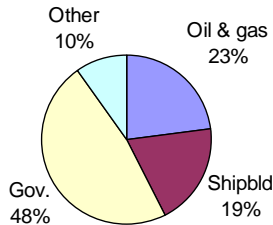
We value shipbuilding R&D at €1.8bn and its future growth is mainly a function of future growth of revenues. Centres of shipbuilding R&D exist through Europe and SE Asia.

The oil & gas industry is estimated to spend €2.5bn but in future years this must increase in line with the technical challenges that will be faced. Major centres are Brazil, France, Norway, the UK and the USA. (Our estimates are based the mid point of figures produced separately by McKinsey and Shell.)

Other marine industries we believe total some €1bn in annual R&D spend.

Government is a major spender with over 1,200 research vessels operating worldwide. The USA leads and we estimate NOAA's marine budget at €2bn. Other countries probably total €3.0bn. The response to global warming is likely to increase this in future years.

Figure 19-3: Marine R&D by Sector



Our figures exclude the important military naval R&D sector where the US accounts for €13bn and the world total could be €26bn. This is important to the civil sector, not only in terms of direct military contracts which can financially underpin companies, but also the technological spin-off into civil applications. The US Navy budget for development, testing & evaluation has increased from \$14.9bn in 2004 to \$16.3bn in 2005. This includes £477m for basic research, \$564 for applied research, \$677 for advanced technology development, \$2.8bn for advanced components development and \$8bn for system development and demonstration.⁷⁴

The US has a programme to specifically involve SMEs in military R&D.

19.2. European Market

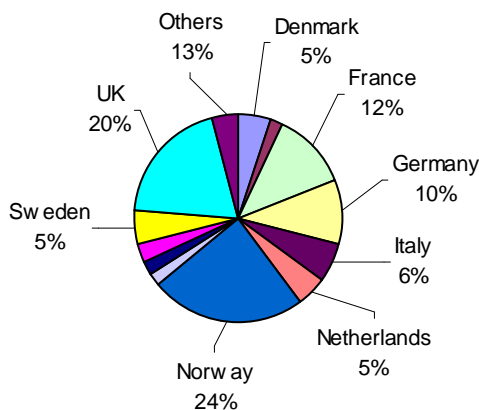


Figure 19-4: European R&D Sector Segmentation 2005

Considering total R&D throughout Europe (not just marine) Eurostat states – “R&D is a driving force behind economic growth, job creation, innovation of new products and increasing quality of products in general, as well as improvements in healthcare and environmental protection. At the Lisbon summit in 2000, The European Council set a clear strategic objective from Europe in the current decade: to make Europe the most competitive and dynamic knowledge-based economy in the world.”⁷⁵

There has been some progress in this. In terms of patents filed per head of population in 2001, Finland, Germany, Norway and Sweden greatly exceeded the USA despite the USA's higher total R&D spend measured as a percentage of GDP.

“R&D intensity is highest in Sweden and Finland (3.4 and 4.3% of GDP) but total expenditure greatest in Germany, France and the UK. Portugal, Denmark and Ireland (1.2%) show the highest real growth rate in R&D expenditure.”⁷⁵

Western Europe is responsible for a major part of world R&D activity, probably only second to the USA. The majority of R&D expenditure in Europe comes from industry and in the EU15 has grown steadily to reach about 58% in 2001.

Offshore Oil & Gas – This has benefited from major research programmes in France, Norway and the UK, the resulting products and technologies being sold worldwide. In the past considerable European Commission funding has been applied to programmes such as ‘Hydrocarbons Research’ with the aim of

⁷⁴ *Sea Technology Buyers Guide/ Directory 2005*

⁷⁵ *Eurostat Yearbook 2004*

reducing dependency on OPEC oil supplies by development of reserves offshore Europe. However, EU official focus has now moved onto renewable energy.

Initially, incoming oil companies were 'encouraged' to invest in R&D as part of the UK licensing requirements until this fell foul of EU regulations. Norway, the other major player was mainly the province of the Norwegian state oil companies who invested heavily.

Nowadays, the main application of oil company R&D funds is in joint industry programmes (JIP) which are often trans-national and where they can access 100% of the results for a fraction of the cost. However, major oil companies tend to keep any 'competitive edge' R&D in-house or contract it out on a confidential basis to commercial companies or universities.

The main technical challenges are now at the extremes of the sector: deepwater, exploiting the many remaining small shallow water fields and maximising recovery from depleting fields ('brown fields'). Within Scotland the government funded ITI Energy has initiated a significant programme to address its mature oil & gas assets. Other programmes include the US Deepstar aimed at the challenges of deepwater and there are programmes operating in Norway and Brazil.

A major challenge is for the service and supply sector to obtain R&D funding in an environment where oil & gas companies increasingly regard themselves as purchasers of hardware and services and leave R&D to the supply chain.

Shipbuilding – Fuel price increases have resulted in growing pressures to reduce vessel operating costs and a major challenge is to radically improve propulsion efficiency. Engine emission reduction is also a significant challenge in light of EU requirements.

As with many other sectors, there is an increasing need for application of higher levels of control and automation and overall safety. The shipbuilding industry in Europe reports spending 10% of revenues in R&D, however, much of this is associated with the need to develop specific design variations for the special vessels that dominate European yards' production and we use 5%.

Other Industries – Offshore renewable energy is now a particular area of focus for the UK and some other European countries.

Government – This includes the various facets of government-funded academic research carried out in universities and other institutions.

19.3. Challenges

The long-term drivers are well known:

- global warming
- population growth
- demographic change
- the rise of the developing economies.

Major R&D challenges ahead, including:

Oil & Gas – Increasing exploitation of gas reserves in light of reducing oil supplies, increasing oil & gas recovery from brown fields and greater water depths, and economically developing small fields.

Renewable Energy – Reducing capital costs and improving reliability. Operating wind farms in deeper waters and at greater distances from the shore. Development of wave and tidal current power.

Methane Hydrates – We expect increasing efforts to commercially exploit this potentially large deepwater energy resource. (Significant projects are already underway in Japan.)

Shipbuilding – How to employ technology to counter high European labour costs and the threat of China’s penetration of the ‘special vessels’ sector that accounts for much of Europe’s business.

Marine Biotechnology – Is likely to receive increasing attention as its large potential is more widely recognised.

Perhaps one long-term concern should be the development of major R&D capabilities in Asia and the growing power of these countries to ‘undercut’ established Western centres in attracting commercial R&D funds. We expect countries such as China, India and Russia to become increasingly competitive due to low labour costs (a graduate with a masters degree can be employed in India at 25% of the cost of an equivalent person in the USA).

Offering to undertake RD in a developing country is often seen as a way to deliver local content and the intellectual property obtained is more readily exportable than profits.

A challenge for Western governments will increasingly be how to anchor technology development in their own countries in the light of increasing competition for funds.

20. UNDERWATER VEHICLE OPERATIONS

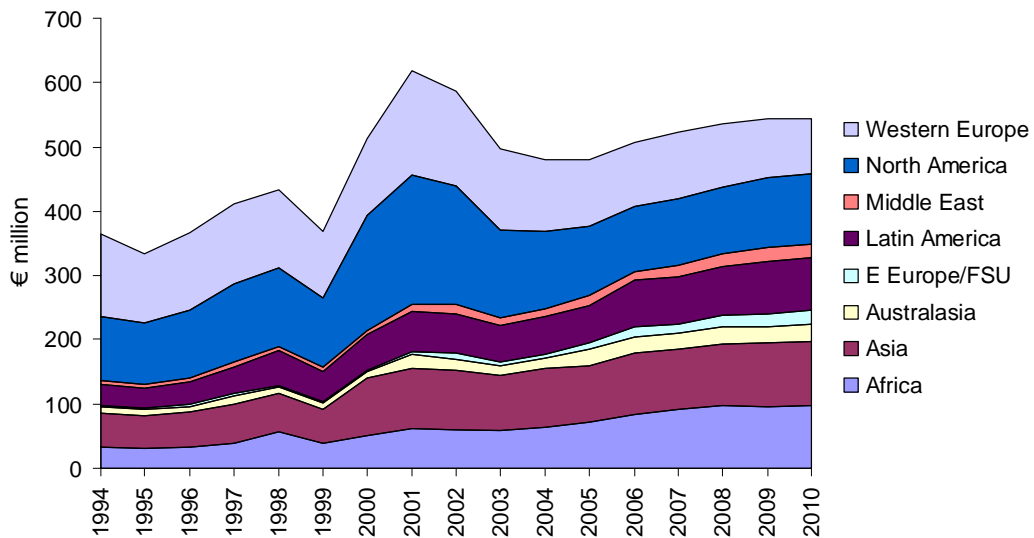


Figure 20-1: Underwater Vehicle Operations – World Market

Source: Douglas-Westwood

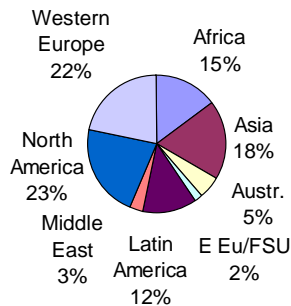


Figure 20-2: Underwater Vehicle Operations – World Regions Segmentation 2005

We estimate that revenues of the underwater vehicles operations sector will exceed €500 million in 2005. Activity will grow until 2010 after which there may be some slight flattening off as European oil & gas sector activity falls.

UW Vehicle Operations	2005	2010
World €M	479	545
Europe €M	103	87

Definition – Revenues from ROV and AUV operations. (Capital expenditure is included in the ‘Underwater Technology’ sector.
Methodology –The major source of revenues is offshore oil & gas. We have analysed individual activities and developed demand for 2004 and valued against ROV operators published revenues. Forecasts are based on those used for the offshore oil & gas sector.

20.1. Overview

Underwater vehicles are mainly of two types, cable-powered and controlled remotely operated underwater vehicles (ROVs) and autonomous underwater vehicles (AUVs).

ROVs have been in operation since the late 1970s and more than 5,600 have been built to date, of which ‘Eyeballs’ (small observation vehicles) total over 2,600 units. Of the large ‘Work’ class ROVs over 900 units have been built of 132 different models.⁷⁶ Of these, we estimate that some 500 vehicles are in commercial operation worldwide. (The others are in military, academic or other non-commercial applications, or are no longer in existence.) In this report we concentrate on the operation of commercial work class ROVs.

⁷⁶ ‘The World AUV & ROV Report 2004-2008’, Douglas-Westwood Limited

AUVs have long been the subject of academic and military research with at least 134 models having been built to date – mainly as one off experimental vehicles. AUVs range in size from units weighing several tons to ones that can be held in the hand. However, AUVs only really entered regular commercial operations in 2001 and about four or five units are presently operating.

20.2. Work-Class ROVs

Offshore oil & gas industry operations accounts for the vast amount of commercial work-class ROV activity, employing over 400 vehicles.

Drill support operations, once a technologically challenging task for ROVs has now become what many regard as a routine service business, it is unlikely to offer long-term *major* growth prospects and needs economies of scale which at present are only really enjoyed by the US-based world market leader, Oceaneering.

Construction support is a very different business sector. Development of offshore oil & gas fields in ever increasing water depths is dependant upon high-capability ROVs with large specialised work packages for pipeline connection and other technically and operationally demanding tasks.

Pipeline inspection (sometimes called pipe survey) is a high-tech / high-price operation that provided the original entry point into ROV operations for the survey companies. However, due to costs, only a small percentage of the 200,000 km or so of installed pipeline and umbilical cables are inspected each year resulting in only a handful of vehicles being required and a small total market. Inspection is also carried out of offshore platforms and other facilities.

Submarine cables provided a major boost to the ROV industry with vehicles being used for cable burial. The rapid growth of the internet resulted in about 40,000 km of cable being installed in 1998 and over 190,000 km 2001. This activity collapsed with the end of the 'dotcom' stock market boom and released additional ROV capacity into the offshore oil & gas sectors. We believe that about 40 vehicles are now operated by or for the submarine cable installation and maintenance contractors.

Other commercial operations are either infrequent such as the uses of ROVs for wreck location and operations (the recent dives on the *Titanic* and the equally remarkable but less public operations on the wreck of the tanker *Prestige* at 3,800m water depth off Spain and another one at 6,000m off Japan are examples). At the other end of the scale several thousand 'eyeball' ROVs are regularly used for simple observation and inspection tasks, from monitoring commercial diving operations to inspection of ships' hulls for smuggled drugs.

The offshore oil & gas industry is the major civil market for ROV operators and their large work class vehicles (and for a period submarine telecommunications cables also formed a major sector).

Oil & gas is the largest market and operational days are forecast as 86,896 in 2004. We expect the main growth to be in the 'newer' regional markets such as Africa, whilst the mature market of North America will decline and Western Europe at best to remain flat to 2008, although decline should be evident by 2010 as offshore oil & gas production falls.

Overall, we expect a tighter market over the period to impact favourably on day rates, which could see growth in real terms. However, much depends on contractors' determination to control their historic over-reaction to growth and not greatly add excess capacity.

We expect the market for commercial operations of work class ROVs to have been about €479 million in 2004 and to grow to €7575 by 2008. The largest activity and growth will be in the oil & gas sector which is expected to account for 90% of revenues, the other 10% coming from submarine cables. (This is expected to be fairly constant and as most vehicles are installed on cable vessels offers few opportunities for contractors.)

20.3. AUVs

At least 134 autonomous underwater vehicles have been produced to date, but so far only five or so are in regular commercial operations and so they are not taking a significant share of the market for underwater vehicle operations. The most successful has been the Norwegian Kongsberg '*Hugin*' particularly in **deepwater survey** operations for the oil & gas industry. High efficiencies have been demonstrated and remarkable data quality achieved. But deepwater survey is a limited market and new applications are required.

However, new vehicle concepts are emerging. AUVs that can be launched from an oil & gas floating production platform and travel autonomously to remote subsea wellheads and other installation' where it can 'dock' and be connected to power and control from the platform. The French company Cybernetix is developing two vehicles, '*Alive*' and '*Swimmer*' that combine the characteristics of ROVs and AUVs. Another French company, ECA, known for its military vehicles, is developing a pipeline inspection AUV.

20.4. European Market

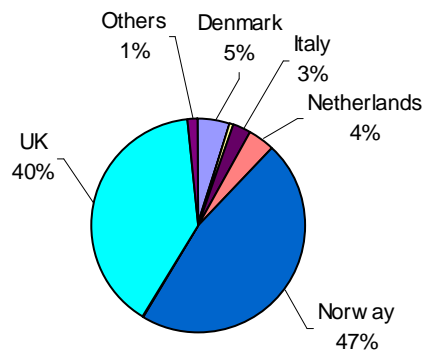


Figure 20-3: European Underwater Vehicle Operations Sector Segmentation 2005

We expect the European market to account for about 22% of underwater vehicle operations in 2005. This share will then slowly reduce as offshore oil & gas activity declines.

Norway and the UK are the largest markets due to the importance of their offshore oil & gas sectors.

21. UNDERWATER TECHNOLOGY

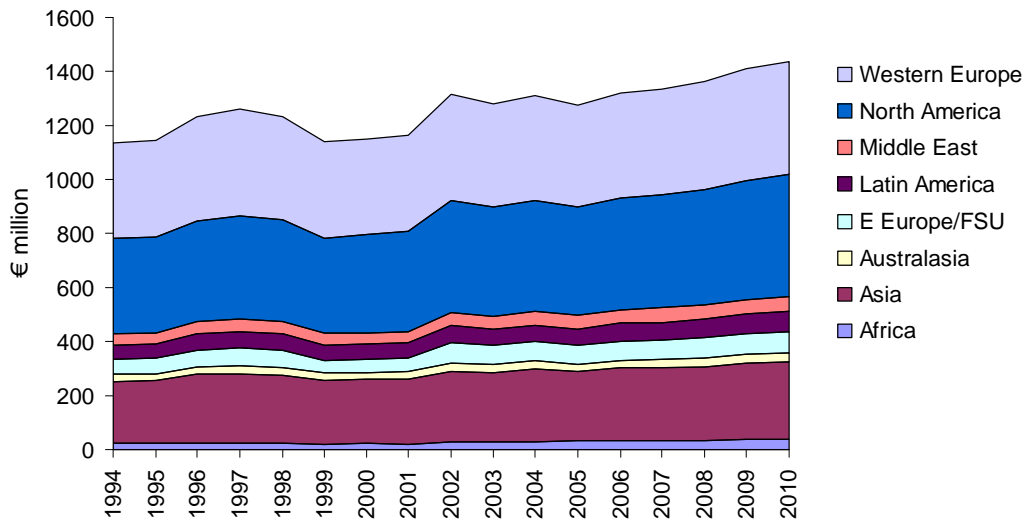


Figure 21-1: Underwater Technology – World Market

Source: Douglas-Westwood

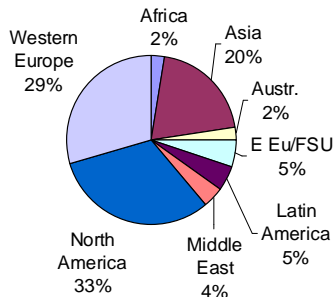


Figure 21-2: Underwater Technology – World Regions Segmentation 2005

As in many other sectors, the market is mainly divided between the key regions of Asia, North America and Western Europe. Although the time series is relatively smooth, in reality there have been some major changes in particular user sectors, such as oil & gas which accounts for the fall in 1999-2001.

Underwater Technology	2005	2010
World €M	1275	1438
Europe €M	376	420

Definition – Hardware & software for underwater operations. (Excludes equipment for subsea oil & gas production.)

Methodology – There is no global data on this subject. Therefore we have assumed that expenditure on underwater technology equates to 10% of the annual value of underwater Vehicle Operations, Ocean Survey and Research & Development. Forecasts are based on growth projections from these individual sectors.

21.1. Overview

For the purposes of this report we define ‘underwater technology’ as the manufacture of the high technology equipment used for underwater operations. This covers a very wide range of activities and in some countries (particularly the USA) it is difficult to separate out technology used by the military from that supplied to civil operations. Underwater technology also includes the surface part of the underwater equipment. The (US-based) Sea Technology Buyers Guide lists over 600 supplier companies worldwide.

Their main clients (apart from the military) are those associated with offshore oil & gas, hydrographic survey, oceanographic research and all other underwater operations. The common factor that links all parts of the sector is a high electronics content. Underwater technology therefore includes the manufacture of:

- Underwater vehicles (ROVs, AUVs)
- Oceanographic instrumentation and deployment systems (e.g. bottom landers)
- Sonars, other survey sensors and survey systems
- Underwater navigation systems
- Underwater cameras and lighting systems.

21.2. Underwater Vehicles

Class	Total
Eyeball	2656
Work	914
Military	1733
Light work	135
Research	113
Burial	58
Unknown	34
Heavy Work	13
Other	9
Total	5665

Table 21-1: ROVs Produced

ROVs – The main manufacturing sectors are:

- small ‘eyeball’ ROVs typically sold at \$10-50,000 with many thousand produced to date
- large ‘work-class’ ROVs at typically \$1-3 million with about 500 in operation
- military ROVs, mainly for mine countermeasures, are produced in large numbers, sometimes 500-1,200 per model. (Military vehicles, although discussed, are excluded from our forecasts.)

Source: ‘The World AUV & ROV Report’

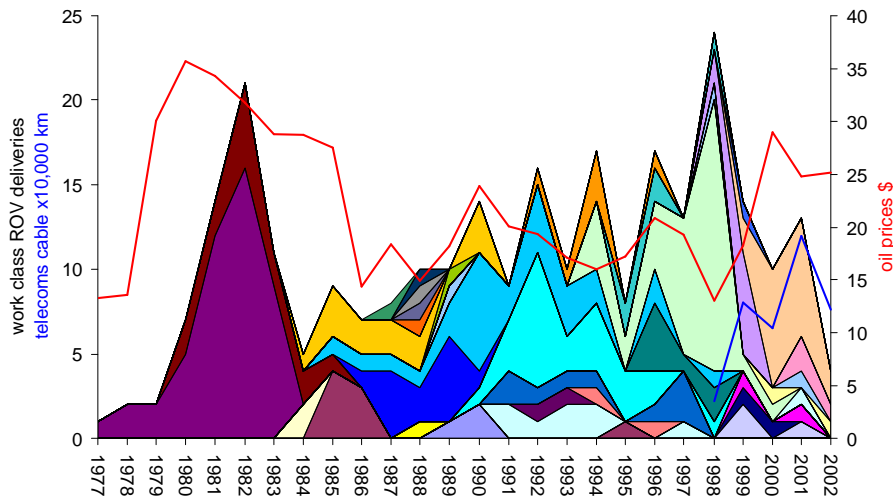


Figure 21-3: Perry Slingsby Systems Work Class ROV Deliveries

Source: ‘The World AUV & ROV Report’. Data courtesy of Perry Slingsby Systems, analysis Douglas-Westwood.

ROV manufacture is a very cyclical business. The chart shows Perry Slingsby Systems deliveries of work-class vehicles. The boom in work class ROV deliveries in the early 1980s followed an increase in offshore drilling activity after the 1979 oil price increase. The blue line shows total submarine cable installations, the red line oil price. The different colours in the chart relate to different models of ROVs. ‘Work class’ is the DWL definition covering ROVs >500kg in weight. Military vehicles are excluded.

Although some makers operate in both the military and civil sectors, the military sector, despite being very lucrative, is particularly difficult for companies that are not established defence contractors. The opposite also applies, with many defence contractors being unsuited to the commercial sector. The factors that have impacted on the ROV operators have also determined the fortunes of the manufacturers.

AUVs – there are many types of autonomous vehicles. There is considerable potential for large numbers of single task vehicles to be produced in future years, however in the near-term the main commercial focus is on small numbers of large vehicles.

The World AUV & ROV Report forecast for large AUVs is based on three scenarios. In our highest scenario, the largest potential is for the application of AUVs in shallow water survey – if a cost-effective solution can be developed. This is followed by pipeline vehicles and AUVs for use on floating production systems. In 2005 four of five large AUVs were operating commercially. For 2008 our three scenarios for large AUVs operational are ‘High’ 66, ‘Most Likely’ 26 and ‘Low’ 12.

Deepwater survey is the only commercially proven application to date and due to the relatively low level of commercial activity in the deep oceans and the high efficiency of AUVs in deepwater this is a very limited market. Our ‘High’ scenario is greatly reliant upon the application of AUVs to surveying in continental shelf water depths (a task that employs some 300 survey vessels worldwide). We firmly believe that AUVs will indeed operate in this market – the unknown is when? However, it is likely that the main market development will be outside the five-year time frame of this study.

For the most part AUVs are still “a great idea seeking commercial markets”. To move ahead, AUV developers need to fully understand the potential applications and produce designs to meet clearly defined customer needs. AUVs also have potential in working from floating production systems in deepwater remote locations – this is, however, another situation where operational requirements and work tasks need very clearly defining. Operating AUVs in a ‘dual role’, working from ships that are engaged on other operations offers great potential as the need for a dedicated support vessel often totally undermines AUV economics.

21.3. Other Technology

Demand for underwater technology is influenced by major research initiatives such as the World Ocean Circulation Experiment (WOCE) and the Global Ocean Observing System (GOOS).

There are over 1,200 **research vessels** listed worldwide and the activities of their operator’s results in a significant demand for underwater instrumentation and data recording and processing systems. In addition to ship installed systems such as sonars, equipment deployed ranges from sound velocity measurement systems to drop corers.

There are in excess of 30 **lander** systems in operation around the world. These devices are landed on the seabed to conduct drilling/coring operations, and to return to surface with samples. The total number of landers expected to be developed in the near future is uncertain but there is likely to be demand from the fisheries monitoring sector, as well as from the development of seabed observatory systems such as Neptune.

Moored instrumentation systems include chains include ‘strings’ of various measurement systems.

Profiling buoys are also used. There is a potential market in offering an alternative to existing systems such as the ‘profiling autonomous lagrangian circulation explorer’ (PALACE) buoys. Manufacturers of existing systems have sold in excess of 1,500 units and from 10 to 200 units have been deployed in any one year. Existing initiatives include the placement by 2007 of the ARGO array of 3,000 floats that are deployed with a 300km spacing to profile through the top 2,000m, measuring salinity and temperature. ARGO floats are designed to profile once every 10 days and have a 4-5 year life-span.

Cameras and lighting systems are used in many applications.

21.4. World Market

The main customer industries include ROV operators, research and survey contractors. There is no reliable information available on the size of the global market and to obtain this would require a dedicated study of the sector. However, there are clues in some sectors.

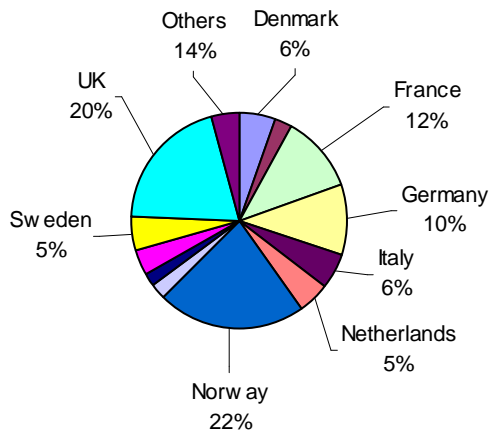
For example, it is likely that ROV deliveries in 1998 exceeded \$100 million, and we have earlier estimated survey quality sonar sales in 1997 at \$107. In addition there are survey systems, oceanographic instrumentation, etc.

In order to develop a view of trends we have assumed 10% of revenues from survey, underwater vehicle operations and research & development expenditure are spent on new and replacement underwater technology. However, this does tend to mask some considerable changes in specific user sectors.

This gives us a world total of some €1.3bn in 2005. (We specifically exclude subsea oil & gas and military equipment.) It is important to note that our totals are segmented by the final use market, in other words expenditure on sonar produced in Germany for use off West Africa is allocated to West Africa, not to the initial customer who may be a survey contractor in the Netherlands.

21.5. European Market

Figure 21-4: European Underwater Technology Sector Segmentation 2005



Norway and the UK, followed by France and Germany form the largest European markets.

22. SECURITY & CONTROL

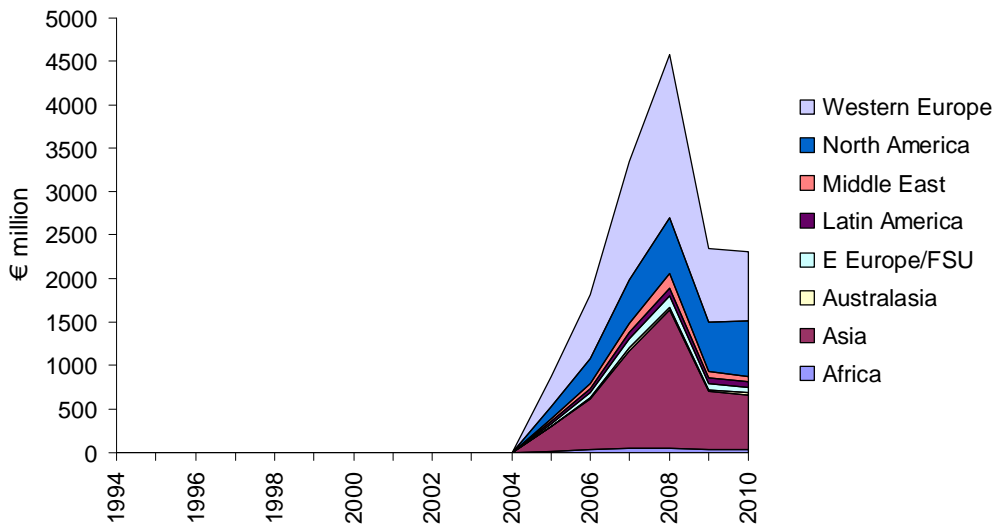


Figure 22-1: Security & Control – World Market

Source: Douglas-Westwood

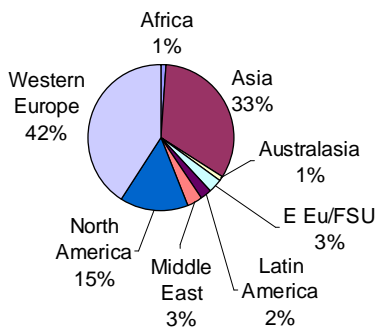


Figure 22-2: Security & Control – World Regions Segmentation 2005

Although much of the cost of post-9/11 marine security activity will fall on European and Asian shipowners in meeting new standards, and operators as container security handling fees, the large expenditure on port security is only just beginning and will be spread over many years.

Security	2005	2010
World €M	877	2320
Europe €M	358	798

Definition – Expenditure required by national and international authorities, mainly in response to the threat from global terrorism.
Methodology – We consider three areas; ship enhancements, port enhancements and container security fees. Expenditure is based on estimates of costs from various sources including the OECD, the US Coastguard budgets and Australian authorities. Forecasts are based on our estimates of the time required to put these measures in place. Container security costs are from major port operators’ statements and forecasts are based on future container traffic estimates.

22.1. Overview

We define this sector as having several drivers including:

- Vessel safety – tracking and traffic management
- Prevention of piracy – a real threat in SE Asia
- The response to global terrorism – a high growth activity.

However, following the events of September 11, 2001, this latter factor now dominates. In 2003 the OECD published a report on the risk factors and economic impact of security in maritime transport.⁷⁷

⁷⁷ Security in Maritime Transport: Risk Factors and Economic Impacts, OECD, 2003

The IMO responded by developing new requirements under the International Convention for Safety of Life at Sea (SOLAS) and these entered use on 1 July 2004. This is supplemented by the International Ship and Port Facility Security Code. The effect was to generate costs for the shipping industries and new business opportunities for suppliers.

The ISPS Code will require company, ship, and port facility security plans, to be approved by the flag administration. The timetable for installation of the Automatic Identification System (AIS) will be advanced. Ship identification numbers must be permanently marked in a visible place on the hull or superstructure. Ships will be issued a Continuous Synopsis Record (CSR), intended to provide an on-board record of the history of the ship, containing such information as all names used by the ship, nations with which it has been registered, identification numbers, and registered owners.

There has been a strong response worldwide:

Europe – The European Commission has developed a proposal for a directive of the European Parliament to enhance port security, to ensure a comprehensive security regime for the entire maritime logistics chain from the vessel to the shipper/port interface to the entire port to the port/hinterland interface. This directive complements the work of the IMO and International Labour Organization (IMO-ILO). In addition a European Security Research Program has been initiated.

US – The Department of Homeland Security issued a fact sheet, ‘*Secure Seas, Open Ports*’, which summarises the various programmes involved in hardening US port infrastructure, verifying the security of vessels before they approach US ports, and better restricting access to the port area.

Many countries are also working closely with the United States in the context of its Container Security Initiative (CSI) and are taking necessary measures to meet the US Customs Service’s requirements to provide cargo declarations 24 hours before loading. One of the main issues arising from the application of maritime security measures is how to meet the costs of these initiatives, especially in its 361 ports.

Technology manifestations include the US Coast Guard’s new underwater port security system has been in development and testing since 2002, is now being deployed to Coast Guard Maritime Safety and Security Teams throughout the USA. The underwater security system – designed to protect port infrastructure and strategically important vessels from underwater threats, including swimmers, divers, and explosive devices – includes specialized sonar, Coast Guard divers trained in underwater searches and inspections, remotely operated vehicles and a variety of methods of stopping underwater intruders.⁷⁸

In addition most significant individual maritime countries have issued guidelines and requirements.

22.2. World Market

The OECD report concluded:

- That a large well-coordinated attack would have the effect of shutting down the entire maritime transport system as governments “scrambled to put in place the appropriate security measures” and that the cost of an attack for the US alone would be \$58bn.
- The costs to combat this were put at \$2bn in port-related security measures.
- There would be savings resulting from electronic customs manifest handling estimated at \$22bn.

The US estimated an expenditure of \$7bn over the next 10 years, the US Coast Guard has estimated that ports would have to spend \$5.4bn over ten years on mandated security enhancements; Australia suggested A\$15.6 over two years. Industry would have costs of \$313 the first year and A\$96 million per year after, and estimates for Australian flagged vessels A\$750,000 to A\$900,000 each.

⁷⁸ <http://www4.trb.org/trb/homepage.nsf/web/security#Seaport> This is a useful site that gathers security-related information. (Ed)

In order to meet the costs incurred to comply with the requirements of the International Ship and Port Facility Security (ISPS) code, P&O Nedlloyd has announced the introduction of a global 'carrier security charge' of US\$6 per container with effect from 1 January 2005.

In 1980 containers represented 6.3% of world traffic. By last year they accounted for 23.8% and this is expected to rise to 26.6% – 386 million TEU (twenty-foot equivalent units) – in 2004. By 2010 container port throughput should reach 432 million TEU. This represents total world container port throughput, including transshipment, when hub ports are used to switch containers from one ship to another.

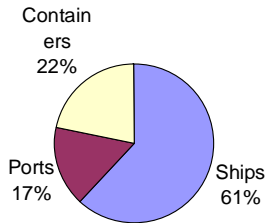


Figure 22-3: Security Expenditure 2005-10

Over the period to 2010, we expect expenditure on maritime security to total nearly €21bn. Although major expenditures will be required in US ports this will continue until 2015. Costs to modify ships will form the majority of expenditure within the medium term.

23. NAVAL SHIPBUILDING

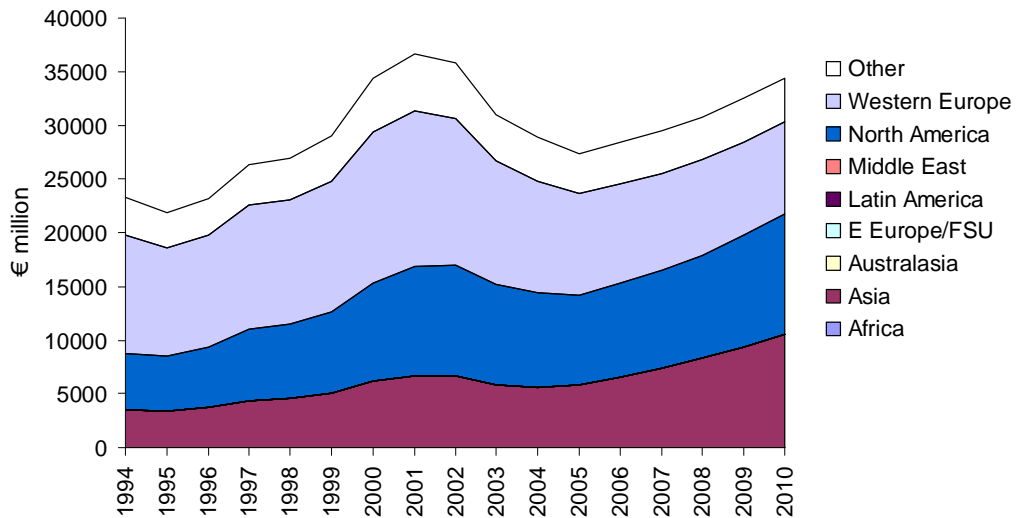
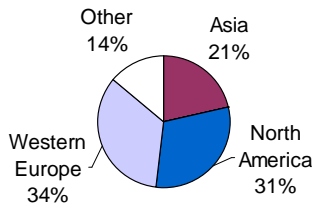


Figure 23-1: Naval Shipbuilding – World Market

Source: Douglas-Westwood

Figure 23-2: Naval Shipbuilding – World Regions Segmentation 2005

Source: Douglas-Westwood



Despite the very large US spend on naval shipbuilding, it is slightly exceeded by Europe. Asia, currently in third place is forecast to grow strongly over the next decade.

Naval Shipbuilding	2005	2010
World €M	27358	34414
Europe €M	3768	4160

Definition – Expenditure on building naval ships.

Methodology – It is based on applying known shares of naval expenditure to published estimates of total world defence expenditure.⁷⁹ Forecasts are based on previous trends in military expenditure and AMI International’s naval expenditure forecasts for the next decade.⁸⁰

23.1. Overview

The area of military spending is a notoriously secretive topic, for obvious reasons, and in the few instances where expenditure is published it may not include various covert programmes. As a result it is difficult to look at the naval sector in any more detail than at world region level. Within countries, announced spending on vessels varies massively year to year as a result of new programmes being implemented or conversely in times of cutbacks. The time series above relates to spending on naval vessels as this is seen to be most relevant to German suppliers and potential opportunities for them. Although very large, in many instances naval shipbuilding is only a fraction of a country’s total naval costs which are often dominated by operational and staff costs (both existing and retired!).

⁷⁹ SIPRI & Janes’ *Fighting Ships*

⁸⁰ AMI International., March 10 2004.

23.2. World

Global defence expenditure, both as a percentage of GDP and inflation-adjusted US dollar terms, has fallen consistently since the end of the Cold War (from a peak of 6% of GDP to 2.7% by 2001).⁸¹ In 2004 we estimate global naval vessel expenditure to have totalled €29bn (\$36bn). Europe currently spends about €11.5bn annually on new vessels, which is expected to decrease by 20-25% over the next decade. Comparably, the US, which publishes its naval vessel expenditure and has an existing fleet of 289 ships, spends an average of €8.7bn on shipbuilding.

The events of 11 September 2001 and the subsequent repercussions could put an end to the downturn, especially for the US, but maybe not for Europe. In world ranking of total military expenditure, the top five countries accounted for 57% of the world's total defence expenditure, with the US way ahead of the others.⁸²

The Asian region has been identified as a major contributor to naval vessel expenditure over the next decade. In 2004, approximately €5.6bn (\$7bn) was spent on naval new construction in the Asia-Pacific region, which is predicted to double by 2009.⁸³ No other region is growing in this way and as a result Asia is likely to overtake the US and Europe in spending in the next few years. The factors leading to Asian growth are individual countries taking on a greater role in regional security and expanding their presence in their own exclusive economic zones (rich in natural resources). This growth therefore seems to reflect regional economic growth and a desire for economic stability and independence rather than as a response to terrorist threats or to be taken as a threat internationally.

In both Europe and the USA changes are happening in naval procurement to reflect the importance of total weapon systems and the complexity of modern vessels. "No longer do companies in traditional sectors... have a stranglehold on prime contracts for their areas of expertise... Suddenly almost every large defence company is beginning to take prime contracts in sectors where it once only played a small part. Part of motivation in Pentagon and euro pushing for cross-overs is the desire for competition. Previously natural choice to lead team assembling a large weapons system was the one making the hull or fuselage. Now what goes inside the metal is in many ways more important..."⁸⁴

General Naval expenditure is also difficult to get accurate data for; the following table illustrates selected countries' expenditure from 1997 to 2002 and forecasts for the US through to 2009. It can be seen from the limited data, that the USA dominates expenditure and will continue to do so in the coming years.

Table 23-1: Naval Expenditure for Selected Countries (\$ billions)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
France	6.5	6.5	6.1	6.0	5.8	4.9							
Italy	4.5	4.7	4.5	4.6	4.0	3.8							
Spain	2.3	2.3	2.2	2.1	2.1	2.8							
UK	7.6	8.2	8.0	7.8	7.5	8.4							
Japan	7.8	6.6	8.8	9.4	8.3	8.3							
India	1.1	1.4	1.5	1.8	1.9	0.0							
Australia	2.1	1.9	2.2	2.2	2.1	0.0							
US	79.6	80.7	84.0	88.8	95.5	101.8	111.2	114.7	119.1	125.4	129.9	137.3	148.6
Canada	2.3	2.4	2.5	2.3	2.4	2.3							

Sources: Janes' Fighting Ships, US National Defence Budget Estimates 2004 & Northern Defence Industries

⁸¹ *Janes' Fighting Ships*

⁸² Northern Defence Industries Ltd, *Operations Plan 2004-5*

⁸³ AMI International press releases

⁸⁴ *Procurement undergoes a sea change*, Financial Times, 1 Dec 2004

23.3. Europe

It is estimated in Germany that 20-25% of all German shipyard activity turnover per year is naval, although this varies with the size of civil and naval deliveries per year. We understand that naval shipbuilding statistics in Germany are confidential (as is the case for most other countries). There has been an increase in the level of employment in naval shipbuilding, from 4,000 people in 2002 to 5,000 in 2004. Although of those employed not all will spend 100% of their time working on naval orders, this depends on civil projects' workload.

Egypt is conducting preliminary negotiations with Germany for the acquisition of an initial two German Navy Type 206A-class diesel-electric submarines (SSKs). The German Navy is preparing to take delivery of the first of its four new Type U212A SSKs by the end of 2005, after which it will gradually phase out its Type 206A fleet, with the opportunity for potential sale on the international market.⁸⁵

In July 2004, the UK announced major cuts to its armed forces, especially to its Royal Navy, with 1,500 personnel cut and 12 warships now expected to retire within the next two years. Reductions in the force include destroyers, general-purpose frigates, mine-hunters and submarines. Though some of these cuts were expected, they still took many in the navy by surprise. Although there is a new build programme planned for the next fifteen years, to replace the existing, if scaled down, fleet.⁸⁶

⁸⁵ *Janes Fighting Ships Online* article, 14 Jan 05

⁸⁶ Wertheim, E, *Proceedings Magazine*, September 2004