Marine industries global market analysis

March 2005

Douglas-Westwood Limited

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Marine Institute
Foras na Mara

"to undertake, to co-ordinate, to promote and to assist in marine research and development and to provide such services related to marine research and development that, in the opinion of the institute, will promote economic development and create employment and protect the marine environment"

Marine Institute Act 1991.

Marine Research and Innovation Strategy

This report is one of a series prepared at the request of the Marine Institute as a contribution to the development of a comprehensive National Marine Research and Innovative Strategy (2006-2012). This strategy being prepared through the course of 2005 will identify the key actions needed to provide sustainable growth and development opportunites that will contribute to socio-economic progress and the protection of the marine environment. This report is designed to identify climate-induced impacts, and necessary related actions, that Foresight/Stateholder groups will have to take into account in preparing future R&D plans and programmes.

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Marine Institute
Foras na Mara

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Abbreviations

AUV	Autonomous Underwater Vehicle
BIM	Bord Iascaigh Mhara (Irish sea fisheries board)
BMF	British Marine Federation
bn	Billion
Capex	Capital Expenditure
CFP	Common Fisheries Policy
CGT	Compensated Gross Tonnage
DGPS	Differential Global Positioning
DNA	Deoxyribonucleic Acid
DWT	Deadweight Tonnage
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organisation (of the United Nations)
FPSO	Floating Production Storage and Offloading (Vessel)
FPSS	Floating Production Semi-submersible
GDP	Gross Domestic Product
GT	Gross Tonnes
GTL	Gas to Liquids
IMPACT	Global Model of Food Supply and Demand for 28 Commodities
ISM	International Management Code for the Safe Operation of Ships and for Pollution Prevention
ISPS	International Ship and Port Facility Security Code
ISL	Institute of Shipping Economics and Logistics
IT	Information Technology
LPG	Liquid Petroleum Gas
M&A	Merger & Acquisition
NOAA	National Oceanographic and Atmospheric Administration
OECD	Organisation for Economic Cooperation and Development
OPEC	Organisation of Petroleum Exporting Countries
Opex	Operational Expenditure
QSP	Quality Seafood Product
R&D	Research & Development
RNA	Ribonucleic Acid
ro-ro	Roll-on/roll-off (Road Transport Ferries)
ROV	Remotely Operated Vehicle
S&P	Survey and Positioning
SME	Small or Medium Sized Enterprise
TEU	Twenty Foot Equivalent Units (Container)
TLP	Tension Leg Platform
UNCLOS	United Nations Conference on the Law Of the Sea
UNCTAD	United Nations Conference on Trade and Development
VLCC	Very Large Crude Carrier ("super tanker")
VTMS	Vessel Traffic Management System
WTO	World Trade Organisation

1 Douglas–Westwood

1.1 COMPANY BACKGROUND

Douglas-Westwood Limited is an independent consultancy that carries out strategic business research, market modelling and analysis. Work is primarily commissioned business research for the international energy and marine industries, their suppliers and investors. Since its formation in 1990, DWL has completed over 340 projects, involving 24 industrial marine sectors worldwide. The firm is UK-based but results of its research is used by clients in 32 countries. Specific marine sector clients range from government agencies worldwide to shipbuilders and international marine equipment suppliers, from the offshore oil & gas majors to renewable energy companies.

Douglas-Westwood's major published work ranges from definitive techno-economic sector studies on Marine Renewable Energy to Marine Propulsion and Ocean Survey.

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2 Introduction & Objectives

2.1 OBJECTIVES

The Marine Institute is the national agency charged with co-ordinating, supporting and undertaking marine research and development in Ireland. The Institute aims to maximise the contribution of the marine resource to sustainable economic development and employment growth.

The Institute is embarking on the development of a new National Marine Research & Innovation Strategy for the Marine Sector in Ireland. This strategy will address the period 2006-2012.

This report was commissioned by the Marine Institute and completed in March 2005. Its aims are to act as an input to the strategy development process and specifically to provide the following:

- An estimate of the global market for marine activities in 2004 for sub-sectors defined by the Institute.
- An estimate of the Irish share of the market.
- An assessment of regional market trends and outturns over the period 1999-2004.
- An estimate of the global market and growth prospects by sub-sector over the period 2005–2009.
- Comments on factors that will impact in the longer term – to 2012.

2.2 LONG-TERM TRENDS

Most business forecasting is based on five years, i.e. 2005 – 2009 for which this report gives quantitive forecasts.

We believe that the major factors that will impact on the marine sector over the period to 2012 are as follows:

- Political & economic change.
- Globalisation.
- Population growth & demographic change.
- Energy supply and demand, and prices.
- Environmental concerns & responses.
- Global terrorism – threats & responses.

It is important to recognise that to some extent, all of the above are linked either in cause or effect. Furthermore many of these major factors are often regarded as being outside the normal remits of forecasting. However, result from long-term trends which provide a backdrop to this report. Our overall view on these is as follows:

Globalisation will continue to be driven by the lower costs of the developing countries and the ageing of populations in the developed world. This will result in an increasing demand for commodity feedstocks, and for energy – particularly oil and liquid fuels for transportation, perhaps increasingly derived from gas.

Energy supply – we believe that oil supplies have a potential to peak sometime after 2013 and if this occurs the consequences could be serious for world economic growth. Some energy prices have already increased dramatically over the past three years and in the light of such increases renewable energy could be a good long-term investment.

Growing industrialisation is likely to have environmental impact and result in increasing expenditure on remedial/preventative measures. However, we note that there is already some awareness in China that their long-term development cannot be based on the Western model.

Growing populations in the Middle East could, unless expectations are managed, result in political change and further fuel political instability.

Disruption – during the last half of the 20th century a major disruption occurred every five to seven years – it is unlikely that the period 2005–2012 will pass without another.

3 Summary & Conclusions

3.1 MARKET SEGMENTATION

Figure 3.1: World Marine Industry Totals 2005–2009 (€ billion)

Services			2454
Shipping	1437	Marine Tourism	928
Marine Commerce	29	Ocean Survey	10
Ports	136	Submarine Telecoms	12
Cruise Industry	67		

Manufacturing			541
Shipping Building	155	Marine IT	16
Marine Equipment	358	Marine Biotechnology	12

Resources			1306
Marine Fisheries	**802**	**Energy**	**489**
Fishing	250	Renewable	13
Aquaculture	134	Oil & Gas	476
Seaweed	33	**Minerals & Aggregates**	**15**
Processing	385		

Education & Research			62
Education & Training	8	Research & Development	54

The world marine industry can be divided into four main areas. After some major items of double counting have been removed we estimate that these have the following values over the period 2005–2009:

- **Services.** Valued at €2,454bn over the period 2005–2009 – dominated by the shipping industry and tourism.
- **Resources.** Valued at €1,306bn over the period 2005–2009 – dominated by Fisheries and Energy.[1]
- **Manufacturing.** Valued at €541bn over the period 2005–2009 – mainly production of equipment for the Shipbuilding and Oil & Gas industries.
- **Education and Research.** Valued at €62bn over the period 2005–2009 – activities associated with Education & Training and R&D for specific sub-sectors.

3.2 KEY DRIVERS OF CHANGE

Growth of the Chinese economy, and to a lesser extent other developing economies, has caused considerable increases in both their demand for commodities and their exports.

The result has been an unprecedented growth in demand for shipping – large amounts of new tonnage have been ordered and will be delivered in 2005–6. The question for the future is whether there will then be excess capacity and depressed rates.

[1] We exclude the value of the energy produced.

The increased demand for commodities has resulted in supply shortages and large price rises in crude oil, steel and other metals.

The US has been importing increasing amounts of goods from China and its growing balance of payments deficit has resulted in a fall in the value of the US dollar against the Euro which has undermined Eurozone companies' competitiveness.

Globalisation and the growth of low-cost manufacturing centres (China, India, E. Europe) is having serious implications for developed countries as it becomes increasingly necessary for some companies to re-locate production in order to remain internationally competitive.

The aging and declining workforce in developed economies and high wage costs are also pushing industries into locating production in the developing world.

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 but one example.

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

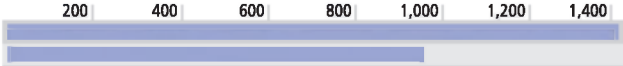
The strong growth in global energy demand, particularly from the developing countries has boosted the offshore oil & gas sector but increasingly raises concerns over a possible limit to oil supplies.

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

3.3 WORLD MARKET SECTORS

Of the marine sectors analysed within the report, there are a few that stand out as either being substantial in today's market, or that are currently small but set for rapid growth. The largest market in 2004 was the shipping and transport sector (€343 billion), a position it will still hold through to 2009. However, it is forecast to experience a decline in Euro terms over the period to 2009, averaging 1.8% per year as shipping rates moderate somewhat. At the other end of the scale is the marine renewable sector, valued in 2004 at only €128 million, but forecast to grow dramatically, by almost 1,000% during the period, to €5.6 billion. These examples illustrate the point that very small sectors may contain great opportunity for new players and activity. Summaries of trends for all sectors are outlined in figure 3.2.

Figure 3.2: World Marine Industry Sector Totals 2005–2009 (€ billion)



	Value € Billion	Annual Growth %	Total Growth %
Shipping & Transport	1,437	1.8%	7%
Marine Tourism	928	3.3%	14%
Offshore Oil & Gas	476	1.7%	12%
Seafood Processing	385	-0.4%	3%
Marine Equipment	358	-0.6%	-1%
Fishing	250	-2.5%	-4%
Shipbuilding	155	-4.0%	-10%
Ports	136	3.2%	18%
Marine Aquaculture	134	4.0%	17%
Cruise Industry	67	4.4%	24%
Research & Develop	54	1.4%	10%
Seaweed	33	3.0%	13%
Marine Commerce	29	-1.8%	7%
Marine IT	16	-0.9%	7%
Minerals & Aggregates	15	2.7%	11%
Renewable Energy	13	131.4%	987%
Marine Biotechnology	12	3.8%	24%
Submarine Telecoms	12	21.8%	97%
Ocean Survey	10	1.3%	11%
Education & Training	8	1.5%	14%

3.4 SERVICES

SHIPPING & TRANSPORT

Page 51 (€343bn in 2004, €308bn in 2009)

	1999–03	2004	2005–09
Irish Market €M	5,612	1,000	9,460
UK Market €M	61,161	20,442	86,201
Europe Market €M	452,186	151,137	637,315
World Market €M	1,011,600	342,743	1,436,684

Shipping and Transport is the largest marine sector, within Europe the cluster has been estimated to comprise 10,000 companies[2] and to form a market worth €151 billion in 2004. The world market for the same year is estimated at €343 billion. Over 90,000 ships of 100 GT or more are registered and in excess of 50,000 are thought to be trading internationally. Of the 11,412 shipowners & operators listed, Greece is the largest owner of tonnage.[3]

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".[4] It is estimated that more than 90% of world trade tonnage is transported by sea and seaborne trade has grown by 400% in the 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, increasing 127% from 1999 (€151 billion) to 2004. However, it is likely that by 2006 additional capacity entering the market will cause rates to fall and we expect a return to slower long-term trends from 2007. Therefore, by 2009 the market is forecast to be valued at €308 billion, representing an average growth rate from 2005 of –1.8%.

[2]Lloyd's List p1, 27 Jan 2004.

[3]Lloyd's Register – Fairplay 'World Shipping Directory' 2004–05'

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

	1999–03	2004	2005–09
Irish Market €M	832	150	780
UK Market €M	10,429	1,842	9,595
Europe Market €M	58,695	10,478	54,569
World Market €M	141,979	25,017	135,526

PORTS

Page 61 (€25bn in 2004, €29bn in 2009)

The Ports sector worldwide was worth €25bn in 2004 with Europe's share amounting to €10.5 billion. There are over 8,000 ports & terminals worldwide of which some 2,000 are significant. However, the top 50 handle the majority of business.

Ports have major economic impact. In the case of Rotterdam, in 2003 5,741 persons were associated with cargo handling, 58,739 were in 'direct port-related employment'. It is claimed that the port generates indirect employment for 250,000 people.

Over the period 1999–2001 the sector increased to €31 billion, returning to previous levels of €25 billion by 2004. Increasing seaborne trade and containerisation means strong growth is underway with the sector forecast to be worth €29.3 billion in 2009, representing 3.2% average annual growth from 2005–2009. However, port congestion is looming and to tackle this major investments are needed in developing port infrastructure worldwide.

	1999–03	2004	2005–09
Irish Market €M	209	55	217
UK Market €M	5,636	1,477	5,846
Europe Market €M	10,437	2,736	10,826
World Market €M	26,092	6,840	28,670

MARINE COMMERCE

Page 57 (€7bn in 2004, €6bn in 2009)

The Marine Commerce sector was worth almost €7 billion in 2004, with Europe's share constituting €2.7 billion, 40% of world activity. 'Marine Commerce' is perhaps a better description than the often-used term 'Marine Services', as the sector ranges from ship operations, brokering and insurance to specialist publications.

This is a long-term growth sector, although the 2005–2009 average growth rate shows a decline of 1.8% per year. This is due to a peak in activity in 2004 (and the continued weakening of the dollar against the Euro) to €6.8 billion, following strong growth in the previous two years. In 2005 activity returned to previous levels and looks set for steady growth, with period growth forecast at 7%. Over the entire reported period, the sector value is set to rise from €4.1 billion in 1999 to €6.1 billion in 2009. London is still the world's leading centre, but its position is increasingly under threat from SE Asia (particularly Singapore). Marine commerce is of major strategic importance as a successful centre tends to cluster decision makers for many associated activities.

OCEAN SURVEY

Page 73 (€2bn in 2004, €2.1bn in 2009)

In 2004 the world value of ocean surveying was €2 billion with Europe representing €538 million of this. The sector satisfies a continuing need for provision of up-to-date charts essential for safe navigation. However, 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 one international company headquartered in the Netherlands. There is also emerging market potential associated with the commissioning of EEZ surveys and areas where Ireland has world-class experience (having completed the world's largest survey) but has no major commercial player.

The world market exhibits a long-term growth trend (if analysed in US dollars, but is stable if represented in Euros, due to the decline in value of the dollar over time in relation to the Euro.)

	1999–03	2004	2005–09
Irish Market €M	64	12	54
UK Market €M	608	104	517
Europe Market €M	3,201	538	2,722
World Market €M	11,715	2,013	10,137

SUBMARINE TELECOMS

Page 79 (€1bn in 2004, €3bn in 2009)

In 2004 the industry is valued at €1bn, after a €7bn capital expenditure peak in 2001 which was followed by a market collapse in 2001–2. This was due to the combined effects of the ending of the 'dotcom' stock market boom and improvement in technology which increased cable bandwidth. The collapse also impacted on some oil & gas service sectors, as cable installation contractors tried to re-deploy resources.

As a global business that views its markets by oceans, this sector is difficult to segment by country or region, but the value of the European share in 2004 is €185 million, constituting 16% of the world. Slow long-term growth is now forecast for submarine cable installations, to €3bn in 2009, representing average annual growth of 21.8% from 2005.

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	–	–	–
Europe Market €M	3312	185	1915
World Market €M	21,270	1,126	11,646

MARINE TOURISM

Page 69 (€168bn in 2004, €198bn in 2009)

Marine tourism is the second largest marine sector in the world and we estimate its value to have been €168bn in 2004. Marine tourism is defined as angling, coastal and inland leisure boating, water sports and cruise liner holidays. Europe is an important market for marine tourism, valued at €72 billion in 2004.

	1999–03	2004	2005–09
Irish Market €M	709	155	848
UK Market €M	–	–	–
Europe Market €M	328,302	71,812	392,695
World Market €M	762,345	168,189	928,267

The marine leisure sector is forecast to enjoy continuing long-term growth in line with the overall increase in tourism and leisure activity to €198 billion in 2009, representing 3.3% annual growth from 2005. This is based on the historical trend exhibited by tourism as a whole (marine and land-based), from an annual value of €142 billion in 1999.

	1999–03	2004	2005–09
Irish Market €M	–	66	–
UK Market €M	5,220	1,104	6,458
Europe Market €M	11,178	2,365	13,829
World Market €M	54,570	12,000	67,436

CRUISE INDUSTRY

Page 65 (€12bn in 2004, €15bn in 2009)

The world revenues for cruise sector operators was estimated at €12bn in 2004, with Europe's share constituting €2.4 billion. 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 more than 70% of passengers. It is of note that 2.7 million Europeans took cruise holidays in 2003 and of these 2 million were in European waters.[5]

From being worth €7.7 billion in 1999 the sector has grown by 56%. Further strong growth is expected globally and regionally, with European cruise passengers increasing to 4 million in 10 years. There is significant growth of smaller specialised cruises in Northern European waters, resulting in an overall 4.4% average annual growth during the forecast period to €14.8 billion in 2009.

In Ireland, ship visits increased from 77 in 2000 to 127 in 2003. Cork and Dublin had in total 75,124 passenger 'calls' in 2004 (compared with Southampton with 536,493[6]) out of a European total of 4.3 million.[7] Purchases of goods and services in Ireland totalled €66 million sustaining 484 full time jobs.[8]

3.5 MARINE FISHERIES

This area includes capture fishing, marine aquaculture, seaweed and seafood processing.

	1999–03	2004	2005–09
Irish Market €M	951	176	788
UK Market €M	4,338	678	3,033
Europe Market €M	32,313	4,758	21,280
World Market €M	362,035	55,983	250,386

FISHING

Page 81 (€56bn in 2004, €49bn in 2009)

World marine capture fisheries production was valued at €56 billion in 2004, with Europe representing 8% of this (€4.8 billion). This is an important industry with strong market demand.

[5]European Cruise Council 2004 (first statistics).

[6]Southampton has a cruise liner terminal and is a turnaround port for a number of cruise liners, thus accounting for the large number of passenger "calls".

[7]GP Wild reported in 'Lloyd's Cruise International', Aug/Sept 2004.

Historically, production value was €67 billion, and is forecast to fall to €49 billion by 2009 as a result of declining catch tonnage worldwide caused by serious resource problems and resulting quota restrictions. There are some opportunities offered by 'new' (previously unexploited) species. Nevertheless, the industry faces a future of continuing global decline worldwide until a point of sustainability can be reached. This decline is forecast at a rate of 2.5% per year in Euros (1% in US Dollars).

MARINE AQUACULTURE

Page 85 (€24bn in 2004, €29bn in 2009)

Marine aquaculture production was valued at €24bn in 2004, with Europe taking a relatively small share at €3.5 billion. Environmental issues and scares have at times depressed demand, within Europe and globally, but the industry has always recovered quickly. Norway leads European production and benefits from a strong international brand.

Between 1996 and 2002 tonnage growth was 9% p.a. and $ value growth 4% p.a. Continuing strong future growth in demand is forecast. There are opportunities for new species development and research opportunities in a number of areas.

As a whole, the industry is experiencing a long-term growth trend, partially associated with filling the capture fishing gap, but also due to the low price of its products. (SE Asia is a low-cost high-volume producer, with annual average forecast growth expected at 4%, reaching €29 billion in 2009.)

	1999–03	2004	2005–09
Irish Market €M	496	111	623
UK Market €M	2,383	554	3,119
Europe Market €M	16,359	3,483	19,621
World Market €M	104,220	23,876	134,492

SEAWEED

Page 89 (€6bn in 2004, €7bn in 2009)

The world seaweed value of wild and cultivated product was €6 billion in 2004. In Europe, seaweed aquaculture has only developed to any commercial extent in France where wakame is being grown for food, although this is not recorded in international data. Irish data shows that in 2002 the country's production was valued at €10 million, but again, this data is not included in international data.

This surprisingly large sector is dominated by China (which produces 75% but is still a net importer) and other Asian producers (15%). The farming of seaweed has expanded rapidly as demand has outstripped the supply available from natural resources. Commercial harvesting occurs in about 35 countries, both in the Northern and Southern Hemispheres.[9]

	1999–03	2004	2005–09
Irish Market €M	10	–	–
UK Market €M	–	–	–
Europe Market €M	–	–	–
World Market €M	28,490	5,988	32,746

[8] 'Report to Cruise Ireland', March 2004. (If applied across all of Europe then a total economic benefit of 3.7bn is suggested).

[9] FAO: 'A Guide to the Seaweed Industry' 2003.

At the start of the reported period seaweed production was valued at €6.4 billion, then dipped in 2000, but the following years have all seen growth, with the 2000 value of production forecast to be reached again in 2006. Forecast annual growth over the period 2005–2009 is estimated at 3%.

	1999–03	2004	2005–09
Irish Market €M	1,447	287	1,411
UK Market €M	6,721	1,232	6,152
Europe Market €M	48,671	8,241	40,901
World Market €M	466,254	79,859	384,878

FISH/SEAFOOD PROCESSING

Page 91 (€80bn in 2004, €78 in 2009)

In 2004 the seafood processing industry is estimated to have been worth €80bn. This is based on the assumption that processing can add up to 100% to the overall value of the raw product (based on analysis of limited data). The main driver is consumers' increasing preference for convenience foods, resulting in more value being added to the raw product.

A considerable export market exists for processed seafoods and high cost European processors, such as Norway, are greatly aided by the establishment and development of a premium brand. A challenge for smaller producers such as Ireland is the need to develop/invest in automation and increase volumes to achieve economies of scale.

Historical and forecast values are based on the stated trends for the fishing and aquaculture sectors (i.e. the availability of the raw product). As a result the industry is forecast to decline, but towards the end of the period the impact in the increase of aquaculture production leads to a slight upturn, but not to levels previously reached. Forecast average annual growth for 2005–2009 is therefore still negative, but only marginally so at –0.4%.

3.6 ENERGY

The marine energy sector is dominated by oil and gas, but growth is beginning in the offshore renewable energy sector.

	1999–03	2004	2005–09
Irish Market €M	478	114	483
UK Market €M	54,699	7,927	30,751
Europe Market €M	133,583	19,112	81,681
World Market €M	504,110	91,146	475,748

OFFSHORE OIL & GAS

Page 95 (€91bn expenditure in 2004, €99bn in 2009)

Expenditure in 2004 was €91 billion worldwide with Europe accounting for €19 billion. Offshore oil and gas is probably the world's largest marine industry in terms of the value of its output (the oil & gas produced), which we estimate was some €700bn in 2004.

Historically, there was an expenditure peak in 2001 of €100 billion, in part due to exchange rate differences caused by valuing a dollar-based market in Euros. Nevertheless, even when valued in Euros, growth is forecast.

The sector is benefiting from a long-term growth in demand and increased oil & gas prices and gas is growing in importance as a fuel. Shallow water producing regions are now in decline (although many small fields remain) causing major oil and gas companies to move to deepwater areas. However, operational spend is still growing in most regions. As numbers of shallow water fixed platform installations decline there is an increase in the use of floating production systems and subsea production. All these drivers are leading to 1.7% growth per year from 2005 to 2009 globally, although Europe is mature with oil production in long-term decline.

MARINE RENEWABLE ENERGY

Page 101 (€0.1bn in 2004, €6bn in 2009)

This tiny new industry was valued globally at €128 million in 2004, with the vast majority of this spend in Europe (€121 million).

It displays the largest growth of any sector and should increase to nearly €6 billion by 2009, representing 131% average annual growth rate 2005 to 2009 (987% over the forecast period). 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 embryonic wave and tidal activity.

Europe will account for 85% of the forecast capital expenditure. The UK will develop first (with 26% of total expenditure to 2009) then Germany will follow on and achieve 40% of total five-year expenditure. European technology leads the world, but the challenge is to reduce costs by use of large 5 MW turbines involving increased distances from the shore and water depths. Ireland has one development to date, but a world-class natural resource.

	1999–03	2004	2005–09
Irish Market €M	46	–	255
UK Market €M	108	109	3,356
Europe Market €M	738	121	11103
World Market €M	741	128	12,649

MINERALS & AGGREGATES

Page 105 (€2.7bn in 2004, €3.1bn in 2009)

The world value of the industry is estimated at €2.7 billion in 2004, with Japan reported to be the largest producer. Within Europe, valued at €1.3 billion in 2004, the UK dominates, with the industry employing 2,500 people. The sector is dominated by the production of aggregates which are supplied to local markets, with offshore

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	3,008	672	3,648
Europe Market €M	5,761	1,344	6,938
World Market €M	11,746	2,741	14,149

dredging reducing the need for onshore pits bringing certain environmental benefits.

Historically the sector has displayed steady growth through to 2004, from €2.3 billion in 1999. The forecast is for growth, averaging 2.7% leading to a value of €3.1 billion in 2009.

3.7 MANUFACTURING

SHIPBUILDING

Page 107 (€38bn in 2004, €30bn in 2009)

The shipbuilding industry was valued at €38 billion in 2004, with Europe's €13 billion share being significant, some one third of this.

1,430 shipbuilders and repairers are 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 the main players, Japan & Korea. Europe is associated with higher tech, low volume vessels (cruise, offshore, etc), but the high value of the Euro has major impact on EU shipbuilders and their suppliers. Ireland is not a significant player.

From a value of €31.9 billion in 1999 the sector peaked (in Euro terms) in 2002 at €40 billion. This peak, we believe, will be followed by a return to long-term lower growth trends, with a market value similar at the end of the forecast period, to the start of the historic period. Therefore, the forecast annual growth rate for 2005–2009 in Euros is –4%, representing the return to previous levels of activity.

	1999–03	2004	2005–09
Irish Market €M	2	0	2
UK Market €M	1,001	234	928
Europe Market €M	63,913	13,143	52,076
World Market €M	183,440	37,746	155,017

MARINE EQUIPMENT

Page 111 (€73bn in 2004, €70bn in 2009)

This is a very large market (€73 billion in 2004) and although other smaller sectors could also be included there are two main segments:

- Shipbuilding, where items such as propulsion systems & machinery total €21bn with over 5,000 suppliers listed worldwide.
- Oil & gas sector, where capital items such as platforms, pipelines, subsea equipment, etc. total €49bn and over 6,000 suppliers are listed worldwide.

The market was worth €64 billion in 1999. Since then, the sector has displayed slight fluctuations, but a general trend of growth, with forecast value of €70 billion for

	1999–03	2004	2005–09
Irish Market €M	1	0	1
UK Market €M	571	133	529
Europe Market €M	94,721	16,675	73,263
World Market €M	355,826	72,871	358,315

2009, representing a slight decline of 0.6% annually from 2005 following a peak of €74 billion in 2006. This is due to a forecast slight decline in shipbuilding.

There is growing technology content and hundreds of high-tech sub-sectors, many of which offer opportunities.

MARINE IT

Page 113 (€3.4bn in 2004, €3.4bn in 2009)

In 2004 the world value of Marine IT was €3.6 billion. Europe's share was €1.4 billion, amounting to nearly 40% of the world market.

There are more than 500 suppliers of 'marine computing' worldwide (mainly SMEs, plus many leisure sector players). IT hardware & software applies to, and is embedded in all aspects of marine activity so it is difficult to value. The major sectors are ship operations (e.g. integrated bridge), equipment support (e.g. engine management), marine operations (e.g. cargo handling) and design.

Marine IT has grown substantially from €1.3 billion in 1999. There is an overall long-term increase in IT content in the marine sector and it could hold significant potential for Ireland. Globally, the sector is set for its long-term steady growth to continue; however, after a peak in 2004, annual growth is forecast at –0.9%, although total period growth 2005–2009 is 7%.

	1999–03	2004	2005–09
Irish Market €M	43	18	78
UK Market €M	648	217	917
Europe Market €M	3,794	1,382	5,872
World Market €M	9,780	3,570	16,012

MARINE BIOTECHNOLOGY

Page 113 (€2.2bn in 2004, €2.6bn in 2009)

In 2004 the global value of marine biotechnology was €2.2 billion. As the sector is in the early stages of its development, there is at present insufficient information on which to base country or regional segmentation of these estimates.

80% of living organisms are found only in aquatic ecosystems, yet little is known about their biochemical characteristics. This is a new sector with considerable interest being shown by the US, Japan, the UK and others. There have been some initial successes (the US Sea Grant programme, with small investments, developed five drugs "with market potential of $2bn p.a.") and considerable long-term potential beyond the timeframe of this report.

	1999–03	2004	2005–09
Irish market €M	–	–	–
UK market €M	–	–	–
Europe market €M	–	–	–
World market €M	11,350	2,190	11,848

The long-term potential of the sector is very large, arguably greater than conventional (non-marine) biotechnology activity which in 2002 generated $35.8 billion of revenues. Annual average growth 2005–2009 is estimated at 3.8%, with a total growth rate of 24% over the forecast period.

"One of the most exciting emerging technology sectors."[10]

3.8 EDUCATION AND RESEARCH

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	–	–	–
Europe Market €M	–	–	–
World Market €M	10,041	1,537	7,691

EDUCATION & TRAINING

Page 121 (>€1.5bn in 2004, €1.6bn in 2009)

Worth €1.5bn in 2004, the sector has three primary activities: seafarer training, offshore workers and higher education. As training may be provided in one country to meet demand from other countries, it is not feasible to segment the 'market' by countries or regions.

- 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 recently (mainly Philippinos). At the same time there is a 4% undersupply of officers which is expected to rise to 12% by 2010. Seafarer training costs range from $5–20K, officers $40K and we estimate that during the period 2005–9 the number of people requiring training will be 177,000.
- Offshore workers 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 in 'marketing' the supplier country and its technology to foreign students. (The new National Maritime College of Ireland, located in Cork, offers a wide range of courses geared specifically towards the commercial shipping sector and the navy.)

Due in part to a recent over-supply of seafarers being trained, historic levels of activity have declined slightly to 2004. This is due to be followed by a slight upturn with other areas within the sector seeing growth, resulting in annual average growth of 1.5% over the period 2005–2009.

[10]Report to the UK Foresight Marine Panel, January 05.

RESEARCH & DEVELOPMENT

Page 123 (€11bn in 2004, €11bn in 2009)

The Marine R&D sector was valued at €11bn in 2004 with Europe's share of the world market exceeding €3.2 billion in 2004. A number of areas make up this global value.

- We currently value shipbuilding R&D at €1.8bn – its growth mainly a function of future increases in shipbuilding revenues.
- The oil & gas industry is estimated to spend €2.5bn, but in future years this increase will be a function of the technical challenges that will be faced.
- Other marine industries, we believe, total €1bn.
- Governments are major spenders with over 1,200 'research' vessels worldwide. The US leads and the National Oceanographic and Atmospheric Administration's (NOAA) marine budget we estimate at €2bn. Other governments probably total of the order of €3bn. The response to global warming is likely to increase this spend. (Our figures exclude the important military naval sector where the US alone accounts for $13bn and the world total could be €26bn.)

Historically, activity has been fairly constant with forecast growth estimated at 1.4% annually from 2005 through to 2009.

	1999–03	2004	2005–09
Irish Market €M	325	62	329
UK Market €M	3,252	621	3,294
Europe Market €M	15,742	3,273	16,471
World Market €M	50,484	10,629	54,320

Table 3.1: World Marine Sectors – Value and Growth (Ranking 2005–09)

				Annual Growth	Total Growth	Irish Share
Euros million	99–03	2004	05–09	2005 to 09	2005 to 09	2004
Shipping & Transport	1,011,600	342,743	1,436,684	–1.8%	7%	0.29%
Marine Tourism	762,345	168,189	928,267	3.3%	14%	0.09%
Offshore Oil & Gas	504,110	91,146	476,044	1.7%	12%	0.13%
Seafood Processing	466,254	79,859	384,878	–0.4%	3%	0.37%
Marine Equipment	355,826	72,871	358,315	–0.6%	–1%	0.00%
Fishing	362,035	55,983	250,386	–2.5%	–4%	0.33%
Shipbuilding	183,440	37,746	155,017	–4.0%	–10%	0.00%
Ports	141,979	25,017	135,526	3.2%	18%	0.60%
Marine Aquaculture	104,220	23,876	134,492	4.0%	17%	0.46%
Cruise Industry	54,570	12,000	67,436	4.4%	24%	0.55%
Research & Development	50,484	10,629	54,320	1.4%	10%	0.81%
Seaweed	28,490	5,988	32,746	3.0%	13%	0.00%
Marine Commerce	26,092	6,840	28,670	–1.8%	7%	0.80%
Marine IT	9,780	3,570	16,012	–0.9%	7%	0.50%
Minerals & Aggregates	12,268	2,741	14,878	2.7%	11%	0.00%
Renewable Energy	741	128	12,649	131.4%	987%	0.00%
Marine Biotechnology	11,350	2,190	11,848	3.8%	24%	0.00%
Submarine Telecoms	21,270	1,126	11,646	21.8%	97%	0.00%
Ocean Survey	11,715	2,013	10,137	1.3%	11%	0.61%
Education & Training	10,041	1,537	7,691	1.5%	14%	0.00%

3.4 CONCLUSIONS

Marine industries are of major economic importance. 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.

The above table 3.1 shows that the marine sectors range greatly in size. The largest ones such as shipping, marine tourism and oil & gas ("traditional areas") offer many niche opportunities and existing world markets. Some very small ones such as marine biotechnology and renewable energy have very high growth prospects and investments in these could offer a large return.

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.[11]

However, some small countries such as Greece, Denmark and the Netherlands have developed major marine industries. As a small country, in 2004 Ireland had a correspondingly small share of world markets, largest in the key sectors of research & development and marine commerce.

We believe that the future potential a small country such as Ireland lies in sectors that are 'internationally mobile' and therefore receptive to advantageous tax regimes, and/or would benefit from application of new technology; or are particularly suited to Ireland's natural environment. For example:

- Aquaculture – a growth sector where Ireland can be promoted as a 'green and clean' producer.
- Maritime commerce – focused around Dublin's shipping and financial community. This however needs an attractive taxation environment.
- Marine renewable energy – Ireland has an outstanding wind, wave and tidal regime.
- Marine technology and biotechnology – capitalising on Ireland's attractions as a location for technological investments.
- Marine education – Ireland has made training investments and has a reputation for academic excellence.
- Ocean survey – specifically related to building on Ireland's recent EEZ survey experience.
- Tourism – as cruise industry and watersports customers seek new destinations.

In developing any strategy for the marine industries it is important to recognise the significance of commercial initiatives (as opposed to research initiatives), particularly within the "traditional sub-sectors". Examples of countries which have developed positions of commercial leadership include Greece with the highest ownership of the world's ship tonnage, Germany in regard to container vessels, Denmark which operates twice its owned tonnage and is a world leader in the manufacture of wind energy technology, the UK in marine commerce (Greek shipping is mainly London-based), and the Netherlands in ports and ocean survey (it claims some 11,800 companies active in marine sectors).[12] In comparison it has been noted that "New York declined as a marine cluster due to tax changes".

[11] "The Economic Impact of Maritime Industries in Europe', Policy Research Corporation NV for the European Commission, 2002.
[12] http://www.kvnr.nl/kvnr/engels.asp

As a small country, Ireland is not limited by having a major share of any world market sector, so in many instances, with application of the correct strategy, there is potential for growth. However, Ireland is limited in marine technology by the lack of a defence sector and predominance of small companies. Therefore niche opportunities must be carefully selected.

Ireland has been successful in attracting high technology companies, such as major players in software and pharmaceuticals. It is now necessary to attract key players in the marine sector and the involvement of the Irish Development Authority (IDA) is vital to such a process. In this respect the Irish 'patented product' tax laws could be helpful in attracting more investment.

The presence of multinationals tends to result in cluster development, both to service them and also spin-off companies, the overall result being creation of jobs.

To maximise its potential, Ireland must become perceived as **a good place to do (marine sector) business.** It is essential to understand and promote the advantages of doing business from a location in Ireland.

A highly skilled workforce provides an opportunity for technology development in key growth areas.

Internationally perceived Irish strengths include a positive image, high IT skills, English language and being fully 'European'.

Opportunities for Ireland can be considered as being in two areas – technical and commercial.

There is no fundamental reason why Dublin could not be developed into a significant **centre of marine finance and commerce** by building on its activities in the financial sector and of the existing maritime companies, and by developing initiatives to attract more.

A **centre for marine technology and education** could be developed in perhaps another location where there is already marine research and/or educational activity.

One possibility that warrants further consideration is a centre for research into marine renewable energy, which could be developed further into a physical **Centre of Excellence** in Marine Technology. However, high level political support would be essential. Models that may be relevant are the Southampton Oceanography Centre and the Scripps Institute in the US.

A key need is to identify areas for R&D that results in both products and in intellectual property development. In the main, the focus needs to be into development of a small number of niche markets. Examples may include Marine IT, Ocean Environmental Monitoring (sensors and data systems), Biotechnology, Renewable Energy, etc.

It is essential to develop and maintain a knowledge base in the selected key areas by means such as research fellowships, for example.

Marine IT may be particularly well suited to Ireland, but further research is needed to identify specific medium-term opportunities.

A significant weakness is probably the low international awareness of Irish marine activities. **Ireland needs a maritime 'brand'**. This is particularly the case at sector level. (Norway, for example, has very high brand recognition for its seafood in major international markets such as the US.)

Above all, Ireland needs high visibility long-term government support of its marine industries and marketing, both internally to raise awareness of marine opportunities and externally to attract foreign key companies.

Once a strategy is developed it is essential to market it, both nationally and internationally.

Table 3.2: Marine Sector Values – Euros and US Dollars (Ranked by 2004 Values)
Marine Sector Values – Euros

Euros Millions	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shipping & Transport	150,754	217,087	216,265	184,495	243,000	342,743	287,748	275,467	274,653	290,886	307,930
Marine Tourism	142,467	147,290	152,288	157,471	162,829	168,189	173,739	179,487	185,440	191,606	197,995
Offshore Oil & Gas	87,141	104,532	109,700	108,022	94,715	91,146	88,237	93,544	97,132	98,011	99,119
Seafood Processing	83,992	99,686	100,432	97,108	85,037	79,859	75,813	76,350	76,930	77,556	78,229
Marine Equipment	64,098	72,141	73,559	74,978	71,052	72,871	70,654	74,078	73,301	70,531	69,751
Marine Fishing	67,495	79,309	78,118	75,034	62,079	55,983	50,983	50,526	50,073	49,625	49,180
Shipbuilding	31,885	37,000	38,090	39,494	36,971	37,746	32,744	33,141	30,835	28,716	29,582
Ports	25,331	30,283	31,071	29,664	25,630	25,017	24,827	26,068	27,111	28,196	29,324
Marine Aquaculture	16,497	20,377	22,313	22,074	22,957	23,876	24,831	25,824	26,857	27,931	29,049
Cruise Industry	7,749	10,483	12,079	12,474	11,785	12,000	11,993	12,803	13,556	14,240	14,845
R&D	10,202	9,982	10,041	10,100	10,160	10,629	10,346	10,757	10,803	11,010	11,404
Marine Commerce	4,154	5,533	5,115	5,292	5,997	6,840	5,742	5,497	5,481	5,805	6,145
Seaweed	6,442	5,074	5,506	5,654	5,814	5,988	6,168	6,353	6,544	6,740	6,942
Marine IT	1,304	1,845	2,023	2,015	2,592	3,570	3,159	3,115	3,122	3,236	3,380
Minerals & Aggregates	2,297	2,375	2,454	2,532	2,610	2,741	2,819	2,897	2,976	3,054	3,132
Marine Biotechnology	1,768	2,212	2,500	2,588	2,282	2,190	2,123	2,240	2,363	2,493	2,630
Ocean Survey	2,020	2,497	2,601	2,465	2,133	2,013	1,925	1,964	2,022	2,082	2,144
Education & Training	1,733	2,193	2,344	2,203	1,568	1,537	1,449	1,479	1,531	1,584	1,649
Submarine Telecoms	4,816	3,919	7,193	4,591	751	1,126	1,502	2,065	2,441	2,685	2,953
Renewable Energy	–	15	71	234	421	128	514	1,365	2,327	2,857	5,586

Marine Sector Values – US Dollars

US$ Millions	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shipping & Transport	160,598	200,412	193,595	174,414	274,950	426,297	389,481	372,857	371,756	393,727	416,797
Marine Tourism	151,771	135,976	136,325	148,867	184,237	209,190	235,164	242,944	251,002	259,348	267,995
Offshore Oil & Gas	92,831	96,503	98,200	102,120	107,168	113,366	119,433	126,616	131,473	132,663	134,163
Seafood Processing	89,477	92,029	89,904	91,802	96,217	99,327	102,617	103,343	104,129	104,975	105,886
Marine Equipment	68,283	66,600	65,848	70,881	80,393	90,636	95,634	100,267	99,217	95,467	94,411
Marine Fishing	71,903	73,217	69,930	70,934	70,242	69,631	69,007	68,389	67,776	67,169	66,567
Shipbuilding	33,968	34,158	34,097	37,336	41,832	46,948	44,320	44,857	41,737	38,868	40,040
Ports	26,985	27,957	27,814	28,043	29,000	31,115	33,605	35,285	36,696	38,164	39,691
Marine Aquaculture	17,575	18,812	19,974	20,868	25,976	29,696	33,610	34,954	36,352	37,806	39,319
Cruise Industry	8,255	9,678	10,813	11,793	13,335	14,925	16,233	17,329	18,348	19,275	20,093
R&D	10,868	9,215	8,988	9,548	11,496	13,221	14,004	14,559	14,623	14,903	15,435
Marine Commerce	4,426	5,108	4,579	5,003	6,785	8,507	7,772	7,441	7,419	7,857	8,317
Seaweed	6,863	4,684	4,929	5,345	6,578	7,448	8,349	8,599	8,857	9,123	9,396
Marine IT	1,390	1,703	1,811	1,905	2,933	4,441	4,276	4,216	4,226	4,380	4,574
Minerals & Aggregates	2,447	2,193	2,196	2,394	2,953	3,409	3,816	3,922	4,028	4,134	4,239
Marine Biotechnology	1,883	2,042	2,238	2,447	2,582	2,724	2,873	3,031	3,198	3,374	3,560
Ocean Survey	2,152	2,305	2,328	2,330	2,413	2,504	2,605	2,658	2,737	2,818	2,903
Education & Training	1,846	2,024	2,099	2,082	1,775	1,911	1,961	2,001	2,072	2,144	2,232
Submarine Telecoms	5,131	3,618	6,439	4,340	850	1,401	2,033	2,795	3,303	3,634	3,997
Renewable Energy	–	14	63	221	476	159	696	1,847	3,150	3,867	7,562
Exchange Rate	0.94	1.08	1.1	1.06	0.88	0.80	0.74	0.74	0.74	0.74	0.74

Exchange rates – Over the past five years there have been major variation in exchange rates, in particular the US dollar against the Euro is of great importance 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 of this can be to change a market that has grown in US dollars into a decline when measured in euros.

4 Methodology & Definitions

4.1 INTRODUCTION

No industrial sector is an isolated economic activity and many of the forecasts for individual sectors are in reality interlinked. For example:

- Shipbuilding is a key forecast as its results also feed into shipping, marine equipment and marine IT.
- Shipping itself drives activity in marine commerce and ports.
- Offshore oil & gas expenditure also feeds part of the marine equipment sector.
- Ocean survey is driven by activity in offshore oil & gas and ports, and to a lesser extent submarine telecoms and marine renewable energy.

Most significantly, virtually all are a function of global economic activity and the factor having greatest impact on this is political action.

Forecasts of the future are reliant upon knowledge of the present and the past. In some cases up-to-date values can be difficult to obtain due to the delay in publication of official statistics.

It is important to note that our forecasts are based on the same processes that we use in forecasting for our commercial clients – what might reasonably be achieved taking into account fundamental market drivers and competition in a sector – in other words, our aim is to generate realistic forecasts that could be used as a basis for business planning. Where there is a choice we err on the side of caution as we are not aiming to state maximum potential growth, other methodologies may result in higher values.

4.2 METHODOLOGY BY SECTOR

SHIPPING

We have developed a $ value for the total world shipping industry for 2003 by using tonnage shares to scale-up from official figures published by individual countries' shipping industries.

The main market driver of shipping industry is the tonnage of seaborne trade (import & export), the volume of which changes as a function of nations' GDP. Shipping activity is measured in tonne-miles for which we have used the ClarkSea index and made tonne-miles projections based on GDP growth taken from IMF and other forecasters.

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) and the value of the shipping sector.

In a rising market ship owner confidence builds and they order more tonnage. However, this may take one to two years to deliver, so supply will lag demand then overshoot as demand peaks. The result is considerable variations in charter rates and thereby values of the shipping sector from year to year. We have considered these factors and after discussions with industry players developed our view of future market values.

MARINE COMMERCE

The value for the sector is based upon scaling up from known figures for London, the largest market. Shipping activity remains the key driver; therefore, demand will grow in line with the shipping sector forecast.

PORTS

We have valued the ports business by taking revenue and traffic figures for the world's leading ports and scaling up. (This value was then compared to other companies' published estimates.) We then applied estimates for growth in seaborne trade used in the shipping section to develop forecasts for future ports business.

CRUISE

Annual expenditure for the US, the largest market, is published by the International Council of Cruise Lines. We have taken this and scaled up to give a view on world market value. Recently European data on embarkations growth and forecasts has been published by the European Cruise Council. Using these two main sources and trends in marine tourism has enabled us to develop a view on annual growth rates in future years.

MARINE TOURISM

In general the tourism sector, including marine tourism, has grown significantly in recent decades and is now a major global industry.

By making assumptions on the proportion of domestic to international tourism in each region, a total tourism value for the world can be estimated. Generally, developing areas are thought to display the reverse situation of the likes of the US or

[13] World Tourism Organisation, 'Tourism Highlights' Edition 2004.

UK, whose populations engage in high levels 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.[13]

To derive 'Marine Tourism', a percentage of each world region's total tourism was estimated. This gives the world marine tourism market in 2004 as €155 billion, 11% of all tourism. This percentage varies widely between regions.

(Another way of calculating the value of world marine tourism could be to apply a multiplier to the Leisure Boating Industry Revenues to estimate 'Marine Tourism' but this approach was not found to be viable.)[14]

OCEAN SURVEY

The market valuations and forecasts are taken from our published study, 'The World Ocean Survey Report'. The approach used in the study is a 'bottom-up' one – from data on proposed activities (such as an offshore field development) we generate our own individual activity forecasts, which, with typical survey task prices, are the inputs to the models that value the individual markets. These are in two main groups, the oil & gas markets and the non-oil markets.

SUBMARINE TELECOMS

Our historic data has been taken from 'The World Ocean Survey Report' and is based on various studies we have carried out in the sector and information sourced from telecom sector specialist KMI. Our forward view is also based on our projection of their short-term global forecasts of total km to which we have applied a regional segmentation based on the location of past installations and changes in regional demand.

FISHING

The global fishing industry is in decline. Our five-year forecasts assume the value of the catch will stay constant from 2002 onwards. This assumption has been made on the basis of increasing production of fish (including shellfish) from aquaculture compensating for the declining production of capture fishing and keeping prices steady. Production is forecast to decline at the same rate as it has since 1994 (0.99% per year).

Marine fishing production can be viewed by tonnage and by value. The values are derived from tonnage data in the Eurostat online database and further broken down

[14]Ireland is the only country where there is available data on which to make this comparison. The boating industry is of varying importance to tourism in general (Ireland: 12%, UK: 2%, US: 5%). This is probably due to the leisure boat industries in different countries varying considerably in structure and overall size. For example, new boat sales make up different proportions of the leisure boating industry (Ireland: 14%, UK: 19% & USA: 35%). There are also likely to be big differences between regions, especially comparing the developed and developing world. For these reasons, this approach was not used.

into molluscs & crustaceans (shellfish) and demersal & pelagic (finfish). This is our best estimate, although the Eurostat/FIGIS/FAO information only contains data on 'miscellaneous' demersal and pelagic fish tonnage, not representing all fish caught. Therefore, we have assigned ratios of demersal/pelagic (of total catch) based on available data and applied those ratios to the total fish tonnage data (which is complete). Eurostat/FIGIS/FAO data on shellfish tonnage appears to be complete and these areas should be valued more accurately than for fish.

The value of each of these subsets was estimated by assigning an average price per tonne, using the FAO 'World Fishery Production: estimated value by group of species' table, containing annual data from 1999–2002. If anything, this approach is likely to estimate the world value of marine capture fisheries conservatively. For available years, BIM data is used for Ireland, and DEFRA data for the UK, rather than our own estimates.

MARINE AQUACULTURE

Between 1996 and 2002 tonnage growth was 9% p.a. and $ value growth 4% p.a. Continuing strong future growth in demand is forecast. Forecast data from 2003/4 onwards assumes a continuation of growth rate in the volume of marine aquaculture produced at 4% per year, based on FAO tonnage and value data.

SEAWEED

The historic value of seaweed production value is based on the Eurostat Aquaculture and Capture fisheries databases data, based on live weight, 1994 to 2002. Our analysis shows a value growth trend of 3% forecast growth per annum and we use this as our future annual growth rate.

FISH/SEAFOOD PROCESSING

There is a generally a lack of information available on this subject, in any useful format for the purposes of the report. Therefore, seafood processing revenues have been estimated as being equivalent to the combined marine aquaculture and fishing product value for each country. This view is based on data from a number of countries including Canada, Ireland and the UK. This 'combined value approach' correlates well with the limited data found on the value of countries' processing industries.

Therefore, the forecast is based on the trends already defined by the fishing and aquaculture sectors (i.e. the availability of the raw product). It could be argued that there is a move towards more processing, with more value being added to the same amount of raw product. Although, for the purposes of the report, we have maintained the trends estimated for fishing and aquaculture production.

OFFSHORE OIL & GAS

Both historic and forecast data is based on 'The World Offshore Oil & Gas Forecast 2005–2015' published by Douglas-Westwood which draws from the 'Energyfiles' system an information service which records activity for each country worldwide.

The forecast methodology does not restrict itself to oil & gas production profiles and direct capital costs for existing fields and specific new projects, as this tends to understate total industry activity and spend. Forecasts are based on estimating yearly production additions on a country by country basis, whereby all elements of geological potential, 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 such as signature bonuses and other overheads are implicitly included in cost estimates.

MARINE RENEWABLE ENERGY

Douglas-Westwood operates the 'World Offshore Wind Database', and 'World Wave & Tidal Database', extensive project databases with up to 60 fields of data on each wind, wave and tidal project in operation and planning worldwide. These data sources have been in place for four years and are constantly updated giving a current view of industry activity. By only using this data which only relates to identified projects, the subsequent market forecasts are grounded in reality.

The modelling process uses the Douglas-Westwood 'slip method' which considers each renewable energy project on an individual basis, assessing its viability in light of market forces such as government policy, financing, availability of contractors, etc. All projects are allocated a 'slip' date which is our view as to when they will come into production. This new date forms the basis of the forecasts of when future expenditure and installations will occur. The $ values used in forecasting are based on actual project costs.

MINERALS & AGGREGATES

Past individual reports for the tonnage of aggregates extracted have been scaled up and a world value estimated. Forecasts are based on taking a view based on historic growth of aggregates demand.

SHIPBUILDING

The Lloyds Fairplay database was used to determine historic ship deliveries and vessel presently on order together with their GT & CGT. This was then compared with results from the Douglas-Westwood study, 'The World Marine Propulsion Report', whose forecast methodology is based on the strong linkage between shipbuilding, GDP growth and world seaborne trade tonnage.

In light of the high recent growth in shipbuilding activity, numbers were also updated using OECD figures for 2003 (tonnages and $/CGT) and also the WES European figures.

MARINE EQUIPMENT

Marine equipment is a very large market and in this report we define it as being comprised of two main customer groups: the shipbuilding and oil & gas sectors. There is growing technology content in both sectors, with hundreds of high-tech sub-sectors ranging from software to underwater connectors to control systems.

We value the world market for marine equipment in the shipbuilding sector in 2004 at €21.3 billion. For the oil & gas sector the capital expenditure component was used, which we value at €49.7 billion in 2004. The overall forecast is, therefore, a function of both the shipbuilding and oil & gas sector forecasts outlined above.

MARINE IT

The very wide range of applications and lack of any official information on the value of IT deployed in the marine sector means that it is difficult to value the overall market. In order attempt this, we have assumed that the IT content of capital expenditure in three key areas of shipping operations (including IT additions to existing ships), newbuild ship capex, and the offshore oil & gas industry averages 0.5%.

The continual need to improve efficiency of operations in all sectors of the marine industries will drive an increasing use of marine IT. Therefore, we assume that this content grew to 0.75% by 2004 and thereafter remains at this proportion.

MARINE BIOTECHNOLOGY

The UK Foresight Report gives a predicted growth rate "exceeding 10% per annum over the next three years" (from 2002). BCC Research in 2003 estimated average growth from 1999 to 2007 as: USA 4.7%, the rest of the world at 6.4% and the total global growth as 5.9%.

Over-estimation of market growth in the early years of technological development is a common failing, therefore in our forecasts we have chosen to use an average growth of 3.8%. In our view it is likely that the anticipated very large market for marine biotechnology will develop outside the time period of this report. (This makes marine biotechnology a very interesting long-term 'investment' prospect.)

EDUCATION & TRAINING

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

We have estimated the market for seafarer training and offshore worker training by taking published data on throughputs of training establishments, manpower updates and industry statements. The in the case of seafarers we considered the world fleet size, manning levels and retirement rates, and developed forecasts based on growth in vessel numbers taken from our shipbuilding forecast. A similar process has been undertaken for offshore oil & gas workers with future growth based on the main sector forecast.

Valuing the 'market' for higher education is a more difficult process; an example is how to clearly separate the education element of universities' activities from research activities. At least 241 establishments worldwide offer marine-related courses and our values are based on estimates of annual student intake and average fees. The forecast is then based on growth at 3% per annum.

RESEARCH & DEVELOPMENT

R&D occurs to a lesser or greater extent in every marine sector. The three largest are:

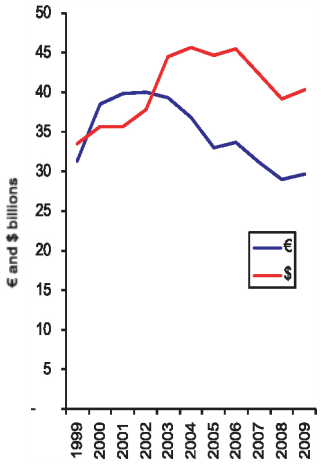
- Oil and Gas – where we use the mid point between separate estimates by Shell and McKinsey.
- Shipbuilding – where claims have been made of 10% of revenues. However, we use a more cautious 5%.

- Government (civil spend) – where the US NOAA's National Ocean Service is perhaps the world's largest spender.

Taking into account other industries, our estimated total for 2004 is some €10.2 billion.

We assume a continuing level of R&D intensity in future years (R&D as a % of total sector sales value) which is then applied to our individual sector forecasts, such as shipbuilding.

Figure 4.2: Shipbuilding Expressed in € and $



Source: Douglas-Westwood Limited

4.3 DEFINITIONS

Exchange Rates – The marine market is an international industry denominated in US$. At times, expressing the value of sectors in euros presents a false picture of markets (see Figure 4.1) and introduces significant statistical difficulty in our analysis.

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

Growth Rate – The average annual growth rate is the sum of each of the five years' annual percentage growth, divided by five (sum of 2004 to 2005… 2008 to 2009 divided by 5). However, the period growth (2005–2009) does not include the change between 2004 and 2005. For example, in the case of Shipping this is significant as a decline occurred between 2004 and 2005 (from €343bn to €288bn), but this decline is not included in the period 2005–2009 (when growth is forecast from €288bn in 2005 to €308bn in 2009). During periods of considerable change, the overall effect can be differences in the 'annual' and 'period' growth rates, sometimes from positive to negative trends and vice versa.

Data – 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 other 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 addition, statistics are often based on voluntary contributions and therefore often incomplete. Examples include the leisure boating industry.

Marine Tourism – This is a sector that is particularly lacking in comparable international statistics.

Secrecy – This is another factor that contributes to a lack of data on national and global market values. The shipping industry operates 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.

Sectors – Definitions of marine sectors differ from country to country (or are not stated), so that information relating to one country is often not directly comparable to that from others.

Models – In a number of instances (shipping, offshore oil & gas and renewable energy are examples) we use our own detailed models of historic and future global activity. In others such as marine tourism we generate estimates.

Values – 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.

Double Counting – It is important to note that sector values cannot always be added as, in many instances, this would cause double counting. In Figure 3.1 we try to avoid some major examples of this.

Industry Structures – Individual countries may apply different structures and definitions of the marine industries.

Sources/Forecasts – In general, forecasts are generated by Douglas-Westwood and historical data from various sources which are referenced in the text.

5 Long-Term Factors

5.1 ECONOMIC AND POLITICAL CHANGE

Economic stability and growth is particularly relevant when considering the continuing reaction to the 'war on terrorism'. The US response to 9/11 may have marked the start of a new type of low-intensity war with occasional flare-ups in different parts of the world.

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 involve using the control of a vital commodity, such as oil.

Accordingly, security of energy supply is also an issue. Most of the world's oil reserves are located in countries with the potential for serious political upheaval in the coming years.

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 ENLARGEMENT

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 enlargement took place in the 1990s, with European agreements liberalising trade. The EU's export trade has risen 73% since 1995 and imports by 81%.

Alongside the increased number of member states, other EU measures are likely to affect the marine sector. One of the most significant is likely to be European maritime transport policy:

- 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.

- Short sea shipping – in 2001 this provided 40% of EU tonne-km and the 'Motorways of the Sea' programme will build on this.
- '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') the 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.

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 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 to those whom 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

This is becoming an issue of growing importance in a number of sectors. Many 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 high-tech capital projects such as those undertaken for the offshore oil & gas industry.

5.2 GLOBALISATION & SEABORNE TRADE

The world market is a growing one, stimulated by increasing consumer demand and the globalisation of production. Low-cost manufacturing areas continue to increase in importance and are increasingly involved in globalised activity. 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, industrial growth in the developing economies is still dependent on the markets in the developed world.

In the marine sector a major impact of this in the past three decades has been the rise of South East Asia as the world's leading shipbuilding region. However, the market positions of 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 to feed its domestic and export industries has recently grown exponentially. 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.

Since an estimated 90% of world trade is carried by sea, this helps boost the demand for shipping services.

Developments in China are 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 utilisation.

However, there is likely to be a dampening of 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 an increase in throughput, especially in container volumes.

A further example of globalisation is in engineering design; offshore industry contracting and some technology companies (particularly in software) are also increasingly establishing operations in India and Eastern Europe.

5.3 DEMOGRAPHIC CHANGE

The world's population is ageing, 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 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.

Size matters. China has 21% of the world population (is a multiple of that of Japan) and this size is already manifesting itself strongly in terms of soaring consumption and exports.

The decline of engineering students is a particular problem in the West. In emerging markets such as India and China about 40% of students take engineering degrees compared with the US at 4%.[15]

5.4 LOW-COST MANUFACTURING

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%.[16] (By comparison, low technology 'resource-based' manufacturing grew at an average of 7.6%.)

The fundamental reason for developing countries' growth is low costs. Electronics company Samsung pays workers in the UK £5.61 (€8) an hour, in Slovakia £1 (€1.4) and in China £0.5 (€0.7).

Another factor is low labour productivity due to shorter working hours in some Eurozone countries compared to countries such as the US. In 1970 the annual number of working hours per capita in the US and the Eurozone countries was

[15]Bill Gates addressing the World Economic Forum. Financial Times, p1, 31 Jan 05

[16]UNIDO database

about 800. It is now about 950 in the US but less than 700 in the Eurozone.[17] In the period 2000–4 the Eurozone achieved annual productivity increases of 0.5–1.0%, the US, 3.8–4.0%.[18]

5.5 ENVIRONMENTAL ISSUES

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

The United Nations Framework Convention on Climate Change was adopted in 1992. In 1997 developed countries, including Ireland, signed the Kyoto Protocol making a commitment to reducing global emissions legally binding. By 2001 Ireland had not made any progress towards limiting its emissions, unlike countries such as Germany and the UK. 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 for, 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. The growing importance of climate change, related environmental monitoring and of aquatic resources as food and of water sources will also impact on a growing demand for monitoring technologies.

5.6 ENERGY SUPPLY & DEMAND

OIL & GAS

Global energy consumption has more than doubled over the past four decades, mostly being driven by the developing economies. Hydrocarbons (oil & natural gas) are currently the world's most important energy source providing some 62% of global energy demand.[19] 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.

Many individuals and 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.

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[17] Paul de Grave, professor of international economics University of Leuven. Financial Times 5 Aug 2004.

[18] Financial Times, p3, 16 Jan 2004.

[19] 'BP Statistical Review of World Energy 2004'.

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.

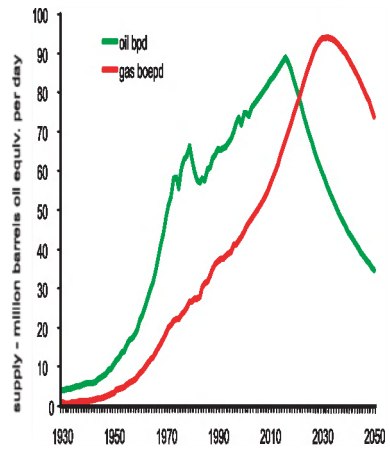
Since 1973, European oil demand has grown by only 6%, the US by 16%, whilst in the developing economies growth has been 202%.

But the picture is changing. 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.

In theory, the reserves that are still available worldwide are considerable – 40 years at current demand is much quoted, but is this true? Such figures do not take into account the problems (both technical and political) in accessing the reserves. There is no doubt that OPEC fully realises the economic problems that high oil prices cause its customer countries which, at their most serious, would again reduce demand.

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.

Figure 5.1: Oil & Gas Supply Forecasts



Source: "The World Oil Supply Report" Douglas-Westwood Limited

NATURAL GAS AND LNG

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 US 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 liquid natural gas (LNG) plants, LNG tankers and

offshore import terminals is set to boom. Analysis indicates a 40% growth in spend, which over the next few years will start to exceed $10 billion per annum.[20] 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 TO INCREASE

Growing world oil demand and reducing non-OPEC production means more tanker movements from the Middle East and West Africa, particularly to the developing countries. 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 on-stream 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 per barrel 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.

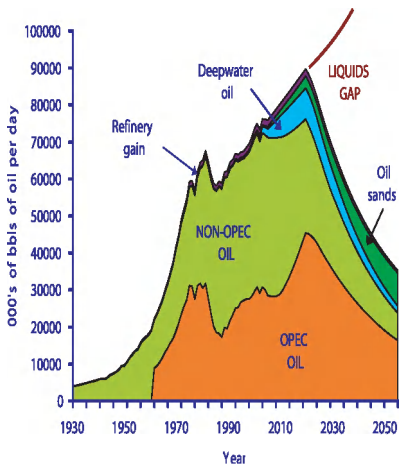
PEAK OIL

As we look ahead the situation of increasing demand and reducing production capacity raises fundamental concerns.

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.

Figure 5.2: Global Oil Supply to Peak?

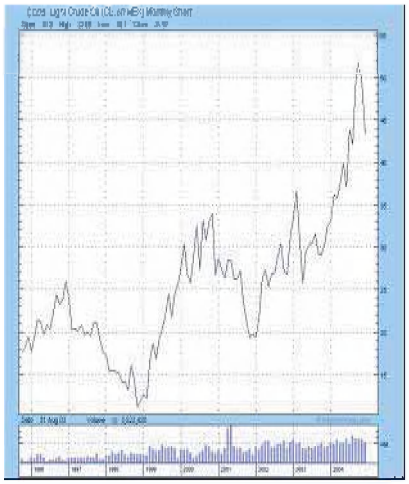


Source: "The World Oil Supply Report" Douglas-Westwood Limited

[20] 'The World LNG & GTL Supply Report', Douglas-Westwood Limited

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.

Figure 5.3: Oil Prices 1996–2004



Source: futures.tradingcharts.com

OTHER ENERGY SOURCES

As discussed earlier, 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.

For Europe, 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 $10 billion over the next five years. The immediate growth market is the UK where we forecast 499 turbines will be installed offshore followed later by Germany with 558. Ireland, with its excellent coastal wind regime has prospects for power generation far above its own needs and consequently for exports to the UK.

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. Here the UK is the market leader, but again Ireland has excellent potential.

ENERGY – A LONG TERM VIEW

Increasing Energy Prices – 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.

Energy Carriers – 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 growth trend to resume. The problem will then become the limits of oil supplies which we believe could occur around 2015. This is likely to reinforce the present strong growth in demand for LNG carriers, increase development of demand for liquid petroleum gas (LPG) carriers and drive a long-term growth in the coal freighters market.

Renewable Energy – This is regarded as a high cost option. However, in light of rising oil, gas and coal prices, past comparisons of the costs of generating energy from renewable sources are probably in the main based on input energy costs for electricity generation now some 50% below present levels.

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.

Investment in renewable energy should be a key factor in national strategy. In light of future shortfalls, investment in energy is a win-win situation.

6 Shipping & Transport

	1999–03	2004	2005–09
Irish Market €M	5,612	1,000	9,460
UK Market €M	61,161	20,442	86,201
Europe Market €M	452,186	151,137	637,315
World Market €M	1,011,600	342,743	1,436,684

Definition – expenditure on all shipping activities. The UNCTAD estimate based on a percentage of the value of total world seaborne trade is referenced by shipowner organisations.

6.1 INTRODUCTION

There are more than 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.[21]

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 in figure 6.1 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.

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

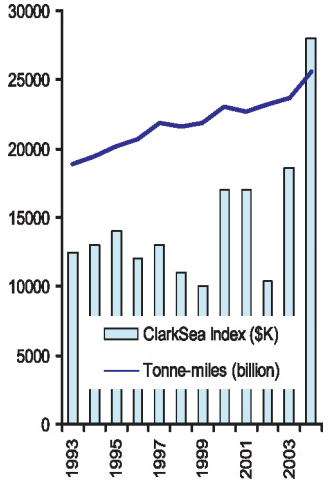
In the container sector, trade growth is forecast at 10.5% in 2005, slowing slightly to 9.7% in 2006. However, on the supply side, the container vessel fleet is expected to increase by 9.8% in 2005, 12.6% in 2006 and 8.8% in 2007. So overall, a 'soft landing' is projected for container shipping rates.[22]

6.2 WORLD SHIPPING MARKET

We estimate merchant shipping was a €243 billion 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 €343bn 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.

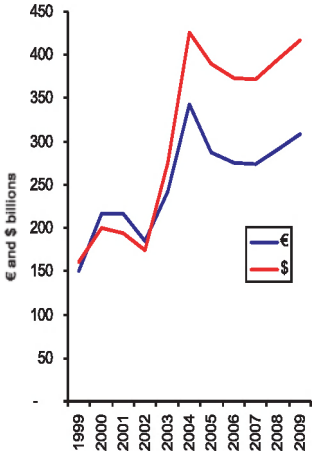
Shipping has traditionally been a boom-bust industry where any major upturn is eventually undermined by over-investment in new vessels. Drewry Shipping has stated that the 14% increase in shipping capacity in 2006 is likely to outstrip demand in that year. The Korea Research Institute expects tanker supply to outstrip demand in 2005.

Figure 6.1: Tonne-miles & Charter Rates



Source: Fernleys &Clarksons

Figure 6.2: Shipping – World Market



Source: Douglas–Westwood

[21] http://www.marisec.org/shippingfacts/keyfacts.htm

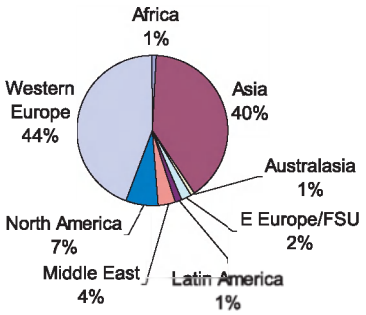
[22] Clarkson's reported in Lloyd's List, p4 2 Jan 05

Table 6.1: Shipping – World Market

	1999–03	2004	2005–09
Africa	7,861	2,693	11,233
Asia	401,104	137,383	573,153
Australasia	6,391	2,189	9,132
E Europe/FSU	22,625	7,749	32,330
Latin America	14,911	5,107	21,308
Middle East	36,610	12,539	52,313
North America	69,912	23,946	99,901
Western Europe	452,186	151,137	637,315
TOTAL (€M)	1011,600	342,743	1436,684

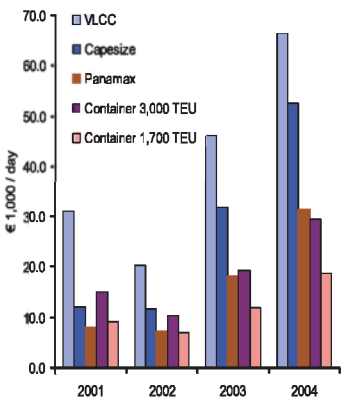
Source: Douglas-Westwood

Figure 6.3: Shipping – Regional Segmentation 2005–2009



Source: Douglas–Westwood

Figure 6.4: Shipping Rates 2001–04



Source: Danish Shipping Association/R.S. Platou

Our own view is of a gradual slowing of shipping sector growth and a return to more normal long-term trends by 2007.

It is difficult to quantify the value of the 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$380 billion (€292bn) in freight rates within the global economy, equivalent to about 5% of total world trade.[23]

In order to check the above we have analysed earnings of some major ship owners. As an example, Danish shipping has earnings of €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.

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.

6.3 CHINA & THE WORLD MARKET

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

Shipowners have responded 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 the 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

[23] 'shipping Facts' http://www.marisec.org/shippingfacts/worldtradevolume.htm

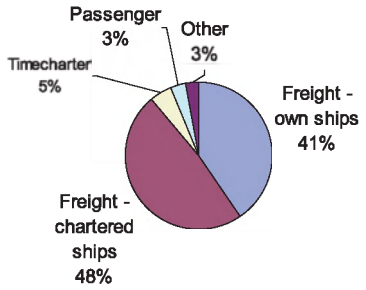
double its GDP every ten years and this is likely to continue for the foreseeable future. However, the recent economic boom could return to its long-term trend with 8% forecast in 2005 compared with an estimated 9.3% in 2004.[25] (It should be noted that unofficial estimates have put China's GDP growth 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.

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.

Figure 6.5: Danish Shipowners Earnings 2003



Source: Danish Shipping – Figures[24]

6.4 EUROPEAN MARKET

Within Europe the market was estimated to be worth €151 billion in 2004. 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 €13.4 billion 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.

[24] 'Danish Shipping – Figures' Danish Shipowners Association. 2004.

[25] 'Survey by the China National Bureau of Statistics' reported in China Daily, 20 December 2004.

Table 6.2: Top 25 Shipowners – Tonnage

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

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 6.2, 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%.[26] 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 newbuilds 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.

France – 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 newbuilds, 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

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

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 brought into the German flagged fleet by end 2005).[27]

Ireland's tax tonnage regime and low corporate tax rate has been of interest to national and European shipowners and the country's sector has shown good development. Older tonnage is being replaced by newer secondhand ships, 47 vessels entered with the Irish Chamber in 2003 – an increase of 68% since 1999. The Irish Maritime Development Office (IMDO) estimate that since 2000 employment in international shipping has increased by an average annual rate of 5.6%.[28] These increases are mainly attributed to the introduction of a tonnage tax regime. A report commissioned by the Marine Institute estimates that shipping and maritime transport was a €1.3bn 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 €12.2 billion and employed 26,800 people and the maritime sector as a whole produced €26.3 billion.

Netherlands – 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 €12.6 billion 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.

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 newbuilds since 2000. Maritime trade increased by 1.4% from 2002, to 290 million tonnes.

Table 6.3: Controlled & Registered Fleets

DWT (M)	2000	2004	Growth
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

[27] Lloyd's List p3, 26 Jan 2005.

[28] Duffy, C, Ireland – growing international shipping centre. Shipping Finance Annual 2004/5.

Sweden – 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.

UK – 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.[29] At the end of 2003, the UK managed nearly 6% of the world's DWT which suggests a turnover of €14.6 billion. At the end of 2004, 71 companies operated 758 ships.

Table 6.4: Annual Average Growth Rate (%)

	2000–05	05–10	10–15	15–22
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

6.5 THE LONG-TERM – 2010 ONWARDS

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 of 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 1.3 billion tonnes (46%) by 2022.[30]

Other forecasts say there will be another 2 billion tonnes of cargo by 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. 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.[31]

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.

[29] "Transport Statistics Report 2003". UK DoT, published Oct 2004.

[30] Global Insight World Trade Service.

[31] "The Demand for Sea Transport 2000 to 2025" Clarksons, 2004.

7 Marine Commerce

	1999–03	2004	2005–09
Irish Market €M	209	55	217
UK Market €M	5,636	1,477	5,846
Europe Market €M	10,437	2,736	10,826
World Market €M	26,092	6,840	28,670

Definition – the sector includes ship operations, brokering and insurance to specialist publications. (We exclude shipping operations revenues which are covered under 'shipping'.)

7.1 INTRODUCTION

Marine Commerce is our preferred term for marine services, 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 commerce operations, the figures given are revenues rather than total sales which would be much greater.

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

7.2 WORLD MARKET

The Marine Commerce sector was worth almost €7 billion in 2004. 'Marine Commerce' is perhaps a better description than the often-used term 'Marine Services', as the sector ranges from ship operations, brokering and insurance to specialist publications.

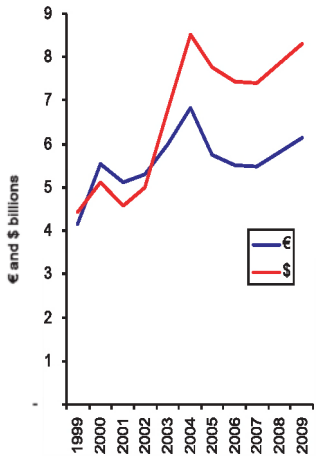
This is a long-term growth sector, although the 2005–2009 average annual growth rate is -1.8% due to a spike in activity in 2004. However, over the entire period sector value is set to rise from €4.1 billion in 1999 to €6.1 billion in 2009. London is still the world's leading centre, but its position is increasingly under threat from SE Asia (particularly Singapore). Marine commerce is of major strategic importance as a successful centre tends to cluster decision makers for many associated activities.

7.3 EUROPEAN MARKET

The European Marine Commerce sector was worth €2.7 billion in 2004, this share constituting 40% of the world. The large share is attributed to clusters of marine financial activity. Usually clustered around a specific city, the marine commerce sector is comprised of many activities. Detailed analysis of marine commerce clusters are rare, figure 7.3, drawn from a recent report, depicts London's activities.[32] The London model is not directly transposable onto marine commerce in other cities, but clearly

[32] "The Future of London's Maritime Services Cluster", 2004. Corporation of London.

Figure 7.1: Marine Commerce – World Market



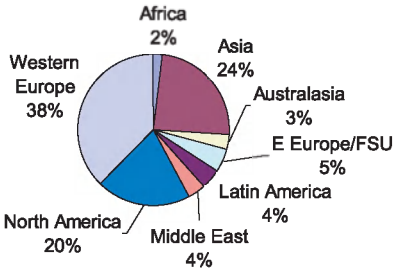
Source: Douglas–Westwood

Table 7.1: Marine Commerce – World Market

	1999–03	2004	2005–09
Africa	522	137	573
Asia	5643	1505	6949
Australasia	783	205	860
E Europe/FSU	1305	342	1433
Latin America	1044	274	1147
Middle East	1044	274	1147
North America	5315	1368	5734
Western Europe	10437	2736	10826
TOTAL (€M)	26092	6840	28670

Source: Douglas-Westwood

Figure 7.2: Marine Commerce – Regional Segmentation 2005–2009



Source: Douglas–Westwood

Table 7.2: Companies in London's Marine Commerce Cluster

Category	No.of Companies
Ship Agency & Forwarding	336
Shipowners, Operators & Managers	206
Marin 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 & Training	12
Marine Personnel	9
Classification Society	8
Media and Publishing	6
Total	1,382

serves to depict the very wide range of participants. Of particular significance is the interaction with the London financial services community.

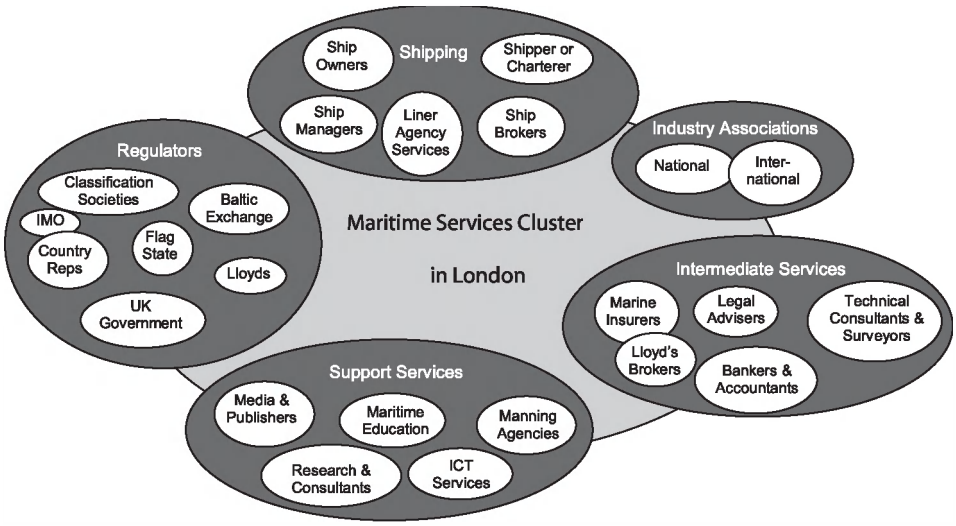
One difference to other marine commerce clusters is the presence of major international organisations such as IMO in London which serve to act as a point of attraction for a wide range of other official bodies. Also of significance is the presence of the Lloyd's insurance market and the Baltic Exchange.

Net overseas earnings (2002) from marine commerce 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. The shipping sector for example, comprised of owners, agencies, brokers & consultants' stated sales of £9.4bn (€14.4bn).

In addition to the numbers in table 7.2, a further 375 companies 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. Significant marine commerce clusters exist in the other major European shipping countries such as Denmark, Germany, the Netherlands and Norway.

Figure 7.3: Marine Commerce Cluster (London)



7.4 THE LONG-TERM – 2010 ONWARDS

The supply of marine commercial 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 the centres from where the market for marine commerce will be supplied. The major factors that may increasingly determine this is the growth of the Asian market (mainly China) and the strength of Singapore as a major financial sector.

8 Ports

	1999–03	2004	2005–09
Irish Market €M	832	150	780
UK Market €M	10,429	1,842	9,595
Europe Market €M	58,695	10,478	54,569
World Market €M	141,979	25,017	135,526

Definition – port revenues based on average prices per tonne of cargo loaded and unloaded.

8.1 INTRODUCTION

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.[33]

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 show a 16% 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 it. 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. US ports are also experiencing severe congestion.

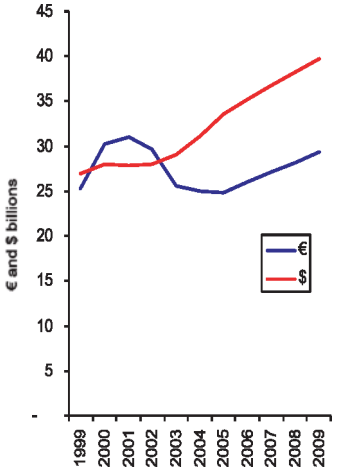
The result is the need for very large investment in expanding port capacity worldwide. For example, Shanghai is spending $10bn in building what it expects to be the world's largest container port. Kuwait is to build a $1.2bn container port becoming operational in stages from 2008. Spain has announced 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.

8.2 WORLD MARKET

The Ports sector worldwide was worth €25bn in 2004. Despite the considerable numbers of ports, 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.[34]

Annual reports of some of the largest ports suggest rates per tonne of between €1.12 to €1.67, whereas the smaller ports can be €2.82 to €3.78. Using these prices suggests a total turnover for the world ports sector of €26.5 billion in 2003. Since 1999 the sector (in € value terms) increased to €31 billion in 2001, then returned to previous levels by 2004, at €25 billion. Analysis of projections of global trade forecasts

Figure 8.1: Ports – World Market



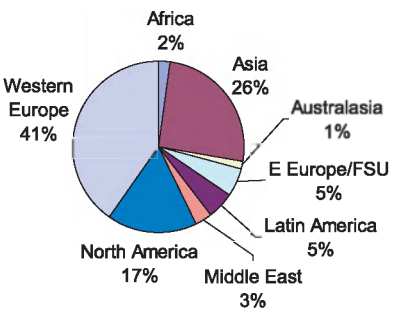
Source: Douglas–Westwood

Table 8.1: Ports – World Market

	1999–03	2004	2005–09
Africa	3152	569	3083
Asia	32198	5988	34632
Australasia	1849	328	1779
E Europe/FSU	6363	1310	7095
Latin America	7964	1248	6762
Middle East	4641	823	4459
North America	27117	4273	23147
Western Europe	58695	10478	54569
TOTAL (€M)	141979	25017	135526

Source: Douglas-Westwood

Figure 8.2: Ports – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[33] "Vessel Calls at US Ports 2003", US Department of Transportation, Marine Administration Department.

[34] e.g. "The US Public Port Finance Survey" relies on voluntary responses and shows net income and tonnage.

suggests the sector will grow to €28 billion by 2009. It should be noted that these values exclude ports' added-value activities. Also privately-owned tanker terminals and passenger operations may not be fully included in these values.

8.3 EUROPEAN MARKET

In 2002, Europe had 985 ports of which 285 handle over one million tonnes of traffic.[35] 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. Europe's share of the market amounted to €10.5 billion in 2004.

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 against $200 for the US and $300 for Japan.

Table 8.2: Top Eight Operators by TEU

	TEU (M)	% Share
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%
TOTAL (World)	319.61	100%

Source: Drewry Shipping/Lloyd's List

8.4 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 privitisation or 'liberalisation' programmes in a number of countries.

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 together are responsible for 18% and total €3.8bn. Scaling up suggests the container sector of the dry-cargo ports world market is €22.7 billion.

There is significant international mergers & acquisition (M&A) activity – recently Dubai Ports International acquired 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.

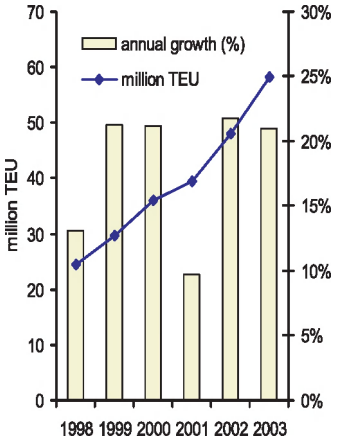
[35] Eurostat

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 in the 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 have risen 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. In 2003 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. The main catalyst for growth is Chinese export activity.[36]

Figure 8.3: Chinese Port Container Throughput



Source: Drewry Shipping/Lloyd's List

8.5 ECONOMIC IMPACT

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.

8.6 THE LONG-TERM – 2010 ONWARDS

Global port activity is set for long term growth, driven by increasing seaborne trade with the world's developing economies. More capital expenditure will be required to expand port capacity and tackle growing congestion. Growth of the cruise market will also bring opportunities for port development. Within Europe, an added dimension will be the desire to increase short haul shipping to counteract growing congestion of land transportation systems.

[36] "Lifeblood of the Global Economy" Times Online quoting from Drewry Shipping Consultants 7 Sept 2004.

9 Cruise Industry

	1999–03	2004	2005–09
Irish market €M	–	66	–
UK market €M	5,220	1,104	6,458
Europe market €M	11,178	2,365	13,829
World market €M	54,570	12,000	67,436

Definition – revenues of cruise vessel operators.

9.1 INTRODUCTION

The cruise industry offers large 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 more than 70% of passengers. The UK is the second largest source market and strong growth is occurring in Germany. Asia was the fastest growing source market in the 1990s before regional economic problems but growth is expected to resume again.

In 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.[37] US ports reported 7.1 million passenger embarcations.

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

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.

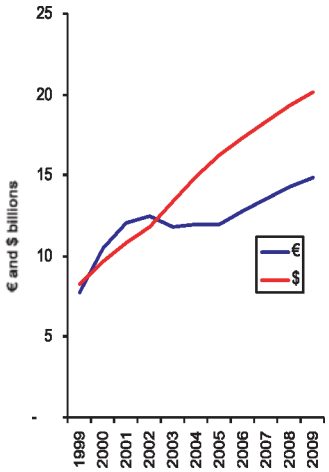
In 2003 there were 258 cruise vessels registered. After a period of overbuilding of cruise vessels, and an anticipated downturn in passengers the cruise industry is again growing strongly. Since 2000, the US industry alone has added 20 ships with 50,000 'lower berths'. At the end of 2004, 21 ships were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

9.2 WORLD MARKET

The world revenues for cruise sector operators was estimated at €12 billion in 2004. Historically, the sector has grown from being worth €7.7 billion in 1999, representing a 56% growth over the period to date. Strong growth is expected globally resulting in a 4.4% average annual growth during the forecast period reaching €14.8 billion in 2009.

[37] The Cruise Industry 2003 Economic Survey in the US' International Council of Cruise Lines.

Figure 9.1: Cruise – World Market



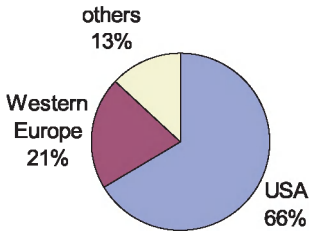
Source: Douglas–Westwood

Table 9.1: Cruise – World Market

	1999–03	2004	2005–09
USA	38562	8254	44822
Western Europe	11178	2365	13829
Others	4830	1381	8785
TOTAL (€M)	54570	12000	67436

Source: Douglas-Westwood

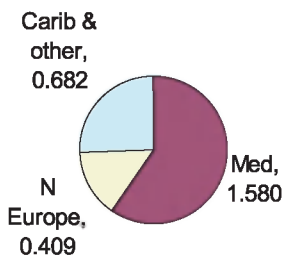
Figure 9.2: Cruise – Regional Segmentation 2005–2009



Source: Douglas–Westwood

Note: 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. Country values are for cruises in northern European waters.

Figure 9.3: European Cruise Destinations (Million Passengers)



Source: European Cruise Council 2004

9.3 EUROPEAN MARKET

2.7 million Europeans took cruise holidays in 2003 and of these 2 million were in European waters.[38] 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.)

In mainland Europe, Spain is the largest source market, Bilbao is spending €13.2 million on a new cruise terminal.

In Ireland, ship visits increased from 77 in 2000 to 127 in 2003 and Cork and Dublin had a total of 75,124 passenger 'calls' in 2004 out of a European total of 4.3 million.[39] Purchases of goods & services in Ireland totalled €66 million sustaining 484 full time jobs.[40]

The Cruise Ireland report shows the direct and overall contribution at each Irish port was:

- Cork: €10.48 million direct, €19.79 million overall and 149 full time equivalent jobs.
- Dublin: €16.18 million €30.55 million overall and 227 full time equivalent jobs.
- Waterford: € 4.63 million €8.74 million overall and 61 full time equivalent jobs.

Cruise industry operators are dominated by the USA, followed by Norway. A primary 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.

9.4 THE LONG-TERM – 2010 ONWARDS

The Cruise Ireland report notes that "the international cruise industry has experienced very significant growth over the past five years and offers further potential as it continues to be the fastest growing sector in the travel and leisure industry. The cruise companies see their industry as profitable and resilient and continue to invest and expand their operations."

The industry is set for long-term growth as whole new market sectors are developed. These include the more casual family oriented 'resort' ships and smaller ships more associated with cultural tours. It is notable that much cruise industry activity is repeat business.

[38] European Cruise Council 2004 (first statistics)

[39] GP Wild reported in Lloyd's cruise International Aug/Sept 2004

[40] Report to Cruise Ireland, March 2004.
(If this ratio is applied across all of Europe then a total economic benefit of €3.7bn is suggested).

Table 9.2: European Country Passenger Calls

Country	Total
Croatia	370,617
Denmark	335,056
Estonia	198,205
Finland	350,570
France	29,628
Germany	267,396
Greece	492,985
Iceland	39,060
Ireland	75,124
Italy	2,524,093
Latvia	52,621
Netherlands	82,955
Norway	323,236
Poland	62,734
Portugal	197,855
Russia	242,862
Spain	1,694,393
Sweden	269,231
UK	917,122
TOTAL	8,525,743

Source: Lloyd's Cruise International August/September 2004

Table 9.3: European Ports Passenger Calls

		Country	Total
1	Barcelona	Spain	832,853
2	Palma Majorca	Spain	664,568
3	Venice	Italy	637,258
4	Southampton	UK	536,493
5	Naples	Italy	535,590
6	Civitavecchia	Italy	521,616
7	Piraeus	Greece	492,985
8	Savona	Italy	468,876
9	Dubrovnik	Croatia	370,617
10	Livorno	Italy	360,753
11	Helsinki	Finland	350,570
12	Copenhagen	Denmark	335,056
13	St Petersburg	Russia	242,862
14	Tallinn	Estonia	198,205
15	Stockholm	Sweden	197,964
16	Lisbon	Portugal	197,855
17	Dover	UK	195,543
18	Oslo	Norway	127,893
19	Bergen	Norway	122,361
20	Cadiz	Spain	112,791
21	Warnemunde/Rost.	Germany	95,403
22	Harwich	UK	86,843
23	Vigo	Spain	84,181
24	Kiel	Germany	83,821
25	Amsterdam	Netherlands	82,955
26	Visby	Sweden	71,267
27	Gdynia	Poland	62,734
28	Bremerhaven	Germany	61,814
29	Riga	Latvia	52,621
30	Guernsey	UK	50,027
31	Dublin	Ireland	43,121
32	Honnigsvag/Nordkapp	Norway	39,871
33	Reykjavik	Iceland	39,060
34	Tromso	Norway	33,111
35	Cork/Cobh	Ireland	32,003
36	Le Havre	France	29,628
37	Hamburg/North Sea	Germany	26,358
38	Forth Ports	UK	24,872
39	Falmouth	UK	23,344

Source: Lloyd's Cruise International August/September 2004

Table 9.4: Cruise Ships by Owner (end 2003)

	Ships	Berths	Av. Berths
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

Source: ISL

10 Marine Tourism

Definition – all expenditure on seawater and freshwater angling, sailing and boating inland and at sea, water sports and inland cruises. Excludes travel and accommodation, and other trips to the beach, etc.

	1999–03	2004	2005–09
Irish Market €M	709	155	848
UK Market €M	–	–	–
Europe Market €M	328,302	71,812	392,695
World Market €M	762,345	168,189	928,267

10.1 INTRODUCTION

The Marine Tourism sector is a difficult sector to gain precise information on, because few countries produce statistics covering all activities. However, there are some statistics for individual leisure activities such as angling and boating.

If we define marine tourism to comprise seawater and freshwater angling, sailing and boating (both inland and at sea), water sports and inland cruises, we estimate the world marine tourism market in 2004 as €168 billion. This figure is approximately 11% of total tourism revenues globally (€1,523 billion).

Comparable Irish figures for the same activities in 2003 are €151 million; however, the sector as a whole is worth €566 million when other activities relevant to the Irish market are included (such as whale watching and trips to the seaside).[41]

10.2 WORLD MARKET

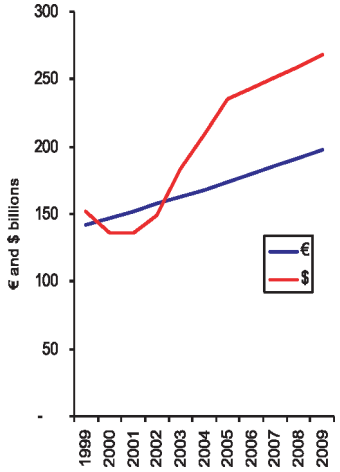
In 2004 we estimate the value of marine tourism in the world to be €168bn. In general the tourism sector, including marine tourism, has grown significantly in recent decades and is a huge industry. Expressing world totals in euros seems to show a decline from 2002 to 2003, although in dollars the reverse is true, again demonstrating the depreciation of the dollar against other currencies.

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 tourism expenditure at €107 billion 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. Generally, developing areas 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.[42] Total world tourism in 2004 is estimated at €1,523bn.

Then to value 'Marine Tourism', a percentage of each world region's total tourism was estimated. This gives the world marine tourism market in 2004 as €155 billion, 11% of all tourism. This percentage varies widely between regions.

Figure 10.1: Marine Tourism – World Market



Source: World Tourism Organization Douglas–Westwood

Table 10.1: Marine Tourism – Industry Segmentation 2003 (€ millions)

	Ireland	UK	USA	World
Leisure Boating	33	1,715	26,511	[33,139]
Total Tourism	971	106,872	490,509	[1,523,433]

Source: Douglas-Westwood, BMF, Irish Marine Institute, NMMA and ICOMIA.

NB: Data in brackets is estimated.

[41] "A National Survey of Water-Based Leisure Activities in Ireland 2003" Marine Institute.

[42] World Tourism Organisation, "Tourism Highlights" Edition 2004.

Another way of calculating the value of world marine tourism could be to apply a multiplier to the Leisure Boating Industry Revenues to estimate 'Marine Tourism' but this approach was not found to be viable.[43]

10.3 EUROPEAN MARKET

We value marine tourism in Western Europe at €72bn in 2004. Over the five years to 1999 this totalled €328bn. We expect growth to continue its long-term trend of 3% annually, and over the period 2005-2009 to total €393bn.

Within Europe, again the only available data for any form of marine tourism is the ICOMIA statistics for the sales of boats and related equipment & accessories.

New leisure boat sales for Ireland totalled €14 million in 2003 compared to €324 million for the UK.

10.4 MARINE LEISURE BOATING

Marine 'Leisure Boating' is a major sub-sector which includes boat sales, repair & building, marina operators, yacht charter and chandlery.

According to BMF (British Marine Federation) statistics the British marine leisure boating industry grew by 8.5% in 2004, increasing its turnover to a total of £1.9 billion (€2.85bn).[44] In six consecutive years of growth from 1999 to 2004, the revenue of the UK leisure boating industry has increased by 57%.

The industry has also shown considerable strength in the export market, growing by 5.6% and bringing in £839 million (€1.26bn) to the UK economy.

The BMF is forecasting further growth in 2005 of 3.3% which would take total industry revenues to over £2 billion (€3bn) for the first time. The industry employs approximately 30,000 people.

Leisure boating involves craft of many sizes, from the sailing dingy to the superyacht. Superyachts (yachts greater than 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 boatbuilding sector to fall from $200 million in 1987 to $75 million in 1994 and 70% of the yards closed. The remaining players ventured into luxury yacht production and

[43] Ireland is the only country that there is available data on which to make this comparison. The boating industry is of varying importance to tourism in general, by country (Ireland: 12%, UK: 2% & US: 5%). This is probably due to the leisure boat industries in different countries varying massively in their make up and overall size. For example, new boat sales make up different proportions of the leisure boating industry (Ireland: 14%, UK: 19% & USA: 35%). There are also likely to be big differences between regions, especially comparing the developed and developing world. For these reasons, this approach was not used.

revenues grew to an estimated $180 million (€144 million) in 2004. A special yacht manufacturing zone is now being built in southern Taiwan.[45]

10.5 THE LONG-TERM – 2010 ONWARDS

The forecast for world international tourist arrivals suggests a 4.1% annual growth rate from 1995 through to 2020. Therefore, it is reasonable to assume that marine tourism will also continue its increase.

Europe's growth rate is lower at 3% over the same period. Applying this same percentage growth to marine tourism suggests a market value of €198 billion in 2009.

[44] "British Marine Federation statistics' 2005.

[45] Financial Times, p28, 31 Jan 05

11 Ocean Survey

	1999–03	2004	2005–09
Irish Market €M	64	12	54
UK Market €M	608	104	517
Europe Market €M	3,201	538	2,722
World Market €M	11,715	2,013	10,137

Definition – all expenditure on seabed survey and shallow seismic survey for civil purposes, such as navigational charts and oil & gas. Excludes deep seismic.

11.1 INTRODUCTION

Survey of the oceans for civilian purposes has a number of distinct sectors including hydrographic survey for the production of navigational charts, exploration and development of oil & gas reserves, port & harbours, submarine cable routes, windfarm installations, etc.

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.[46]

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

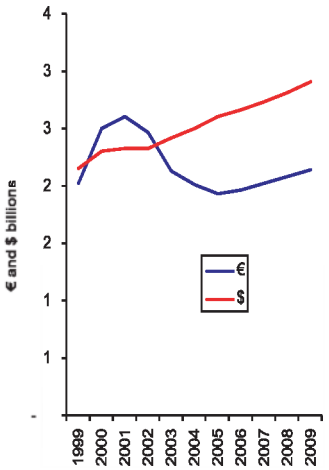
11.2 WORLD MARKET

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. In 2004 the world value of ocean surveying was €2 billion. The world market exhibits a long-term growth trend if analysed in US dollars, and stable if represented in euros, due to the decline in value of the dollar over time, in relation to the euro. 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. Our five-year forecast shows hydrographic charting as the largest sector, followed by oil & gas and port & harbour survey.

11.3 EUROPEAN MARKET

Europe is a major player in this high tech sector (€538 million in 2004), which is dominated by the Netherlands. There is also emerging market potential associated with the commissioning of EEZ surveys. 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 activity. Activity in the other significant markets is mainly a function of hydrographic surveys. Ireland has good experience (having completed the world's largest EEZ survey) but has no major player.

Figure 11.1: Ocean Survey – World Market



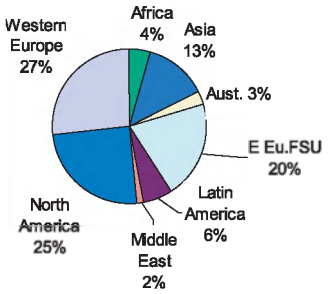
Source: Douglas–Westwood

Table 11.1: Ocean Survey – World Market

	1999–03	2004	2005–09
Africa	383	80	439
Asia	1559	270	1363
Australasia	313	59	285
E Europe/FSU	2310	401	2044
Latin America	664	118	617
Middle East	152	35	160
North America	3133	511	2507
Western Europe	3201	538	2722
TOTAL (€M)	11715	2013	10137

Source: Douglas-Westwood

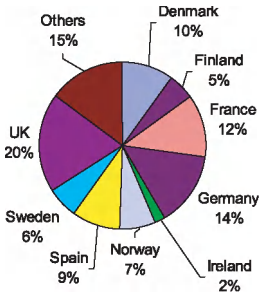
Figure 11.2: Ocean Survey – Regional Segmentation 2005–2009



Source: Douglas–Westwood

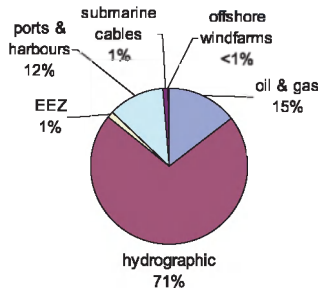
[46] IHO Yearbook 2003

Figure 11.3: Ocean Survey – European Segmentation



Source: Douglas–Westwood

Figure 11.4: Ocean Survey – Sectors



Source: The World Ocean Survey Report, Douglas–Westwood

11.4 BUSINESS SECTORS

The largest activity is **hydrographic survey**, a 'market' we value at €1.4 billion. 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 €352 million for production of about one quarter of the world's marine charts. Scaling up suggests a total annual spend of at least €1.4 billion. 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 these costs are probably not included in the figures.

We estimate that the market for the sale of hydrographic charts exceeded €582 million in 2003.

Offshore oil & gas industry survey is valued at €302 million in 2004. 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 – €233 million (2004). 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.

Submarine cables – €16 million 2004. 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 €104 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.

Exclusive economic zones – €23 million 2004. The definition of exclusive economic zones (EEZ) outside the 200 nautical mile 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.

The seven-year, €32 million survey of Ireland's seabed formally commenced its fourth year of data acquisition in May 2003 and was the largest marine survey ever undertaken anywhere in the world.[47] The *Celtic Explorer*, the main survey vessel, was one of six ships and one aircraft employed in the survey and detailed studies of 420,000 sq km of the seabed have been completed. The shallow-water Phase 2 is now underway.

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 survey discussed earlier) 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.

Offshore windfarms – €1.6 million (2004). 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.

11.5 TECHNOLOGICAL CHALLENGES

Ocean survey is a technology business with large amounts of money invested is survey vessels' data gathering and processing systems.

[47] http://www.gsiseabed.ie/main.htm

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 autonomous underwater vehicles (AUVs) to ocean survey. 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 conventional survey platform.

11.6 THE LONG-TERM – 2010 ONWARDS

Ongoing survey of the sea and oceans is a fundamental need for the establishment of governance mechanisms, 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 navigational 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 more cheaply from commercial contractors. However, we expect that the economic argument will increasingly prevail.

The growth ambitions of the main commercial contractors together with the fall-out resulting from business cycles has meant that rationalisation and consolidation activities have been extensive in the S&P market with one truly global player emerging (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 in to areas such as seismic survey.

12 Submarine Telecoms

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	–	–	–
Europe Market €M	3312	185	1915
World Market €M	21,270	1,126	11,646

Definition – capital expenditure on the manufacture, supply and installation of submarine telephone cables.

12.1 INTRODUCTION

Fibre-optic cables were introduced in 1988. In the next 9 years the investment in fibre-optic cables totalled $19.8bn. The rapid growth of the internet then caused traffic volumes to increase at 80–100% per annum. About 40,000 km of cable was installed in 1998 and over 190,000 km in 2001 at a cost of over €8 billion.

Expected investment in the period 2001 to 2004 was $36 billion[48] and in 1999 a contract was signed for construction of 13 installation & maintenance ships for the proposed 'Project Oxygen'. Then in 2001 "dotcom" technology stocks crashed, causing cable installations to virtually grind to a halt. Projects underway caused the bottom of the market not to occur until 2003.

Considerable amounts of capacity had been brought into being to satisfy the boom; survey vessels, cable lay and burial vessels and the associated hardware such as ROVs and human resources. The collapse of the submarine cable market had major repercussions for these suppliers and caused hardware to be made available for work in the oil & gas sector, depressing day-rates.

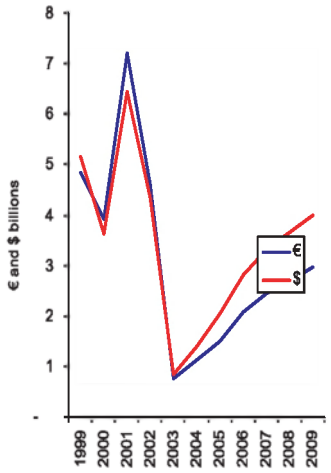
The situation was exacerbated by a massive increase in the capacity of individual cables. TAT11, laid in 1996, had a capacity of 1.6 Gbits/second. The 1999 trans-Atlantic cable, Gemini, had a capacity of 60 Gbit/s. Cables planned for 2001 were 400 Gbits/s.[49]

12.2 WORLD MARKET

In 2004 the submarine telecom industry was valued at €1 billion. The historic data we show is sourced from KMI. Our forward view is also based on our projection of their short-term global forecasts of total km to which we have applied a regional segmentation based on the location of past installations. This is, in practice, difficult to achieve with accuracy as the submarine industry segments its markets by oceans (e.g. Atlantic, Pacific, etc) rather than by regions and countries. We are not aware of significant Irish capital investment in this sector.

Following the dramatic collapse of capital expenditure in the sector from 2001–2003, we believe that growth is again likely. However, this will probably now be at a much more measured pace than in past years. Slow long-term growth is now forecast for submarine cable installations, to €3bn in 2009, representing average annual growth of 21.8% from 2005.

Figure 12.1: Submarine Telecoms – World Market



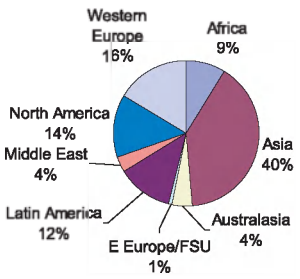
Source: Douglas–Westwood

Table 12.1: Submarine Telecoms – World Market

	1999–03	2004	2005–09
Africa	1539	100	1036
Asia	8982	448	4628
Australasia	998	50	514
E Europe/FSU	171	10	108
Latin America	2575	138	1427
Middle East	721	40	409
North America	2972	156	1608
Western Europe	3312	185	1915
TOTAL (€M)	21270	1126	11646

Source: Douglas-Westwoo

Figure 12.2: Submarine Telecoms – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[48] KMI Corporation.

[49] Foot, D. "Underwater", Summer 1998, p121.

12.3 EUROPEAN MARKET

As a global business that views its markets by oceans, this sector is difficult to segment by country or region, but the European share in 2004 is valued at €185 million, constituting 16% of the world. Its historical activity was shaped by the global factors impacting on the industry, outlined in the Introduction above.

13 Fishing

	1999–03	2004	2005–09
Irish Market €M	951	176	788
UK Market €M	4,338	678	3,033
Europe Market €M	32,313	4,758	21,280
World Market €M	362,035	55,983	250,386

Definition – the value of captured fish and shellfish as defined by the FAO.

13.1 INTRODUCTION

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 subsidised 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.

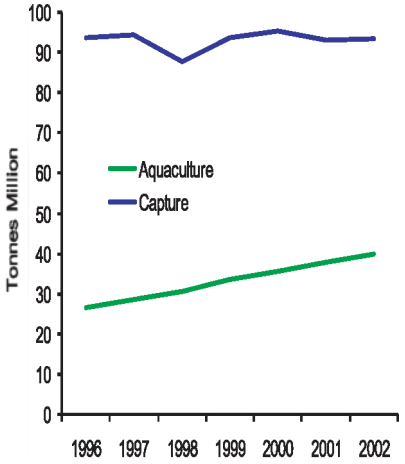
Since 1996 capture fishing tonnage has been at best flat and has shown recent decline. The growing world demand for fish and other seafood is being met by aquaculture where tonnage growth over the period 1996 to 2002 averaged 7% and $ value averaged annual growth of 4%.

Our five-year forecasts assume the value of the catch 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.

Within Europe and elsewhere initiatives have been introduced, such as the EU's CFP (Common Fisheries Policy), with the aim of conserving remaining fish stocks. Globally, the volume of captured fish has been decreasing slightly and this decrease may appear more pronounced if the speculation about China, over-reporting its production (by as much as 43%), are to be believed.[50] In addition, the depreciation of the US dollar against the Euro makes the decline more pronounced when values are viewed in euros rather than dollars.

Marine fishing production 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.

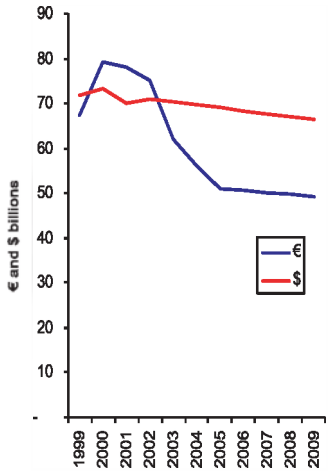
Figure 13.1: Fishing and Aquaculture Production



Source: FAO and Eurostat

[50]Delgado, C et al, , 'The future of fish, issues and trends to 2020' FAO.

Figure 13.2: Fishing – World Market



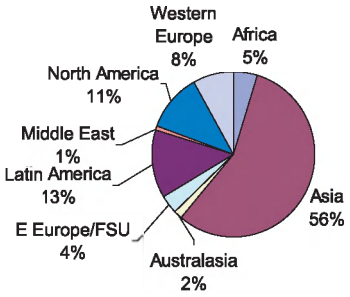
Source: FAO, Eurostat and Douglas–Westwood

Table 13.1: Fishing – World Market

	1999–03	2004	2005–09
Africa	16401	2583	11550
Asia	201183	31387	140377
Australasia	6100	939	4198
E Europe/FSU	14698	2091	9351
Latin America	48698	7403	33108
Middle East	3020	501	2242
North America	39622	6323	28278
Western Europe	32,313	4,758	21,280
TOTAL (€M)	362,035	55,983	250,386

Source: FAO, Eurostat and Douglas-Westwood

Figure 13.3: Fishing – Regional Segmentation 2005–2009



Source: FAO, Eurostat and Douglas–Westwood

13.2 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.[51] The value of Asian production was greater than any other region in 2004, at over €31 billion. 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 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.

In 2004 world marine capture fisheries production was at €56 billion. Historically, production value was €67 billion in 1999, and is forecast to fall to €49 billion by 2009. 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, the industry faces a future of continuing global decline worldwide until a point of sustainability can be reached. This decline is forecast at a rate of 2.5% per year in Euros (0.99% in US Dollars), based on historic trends.

13.3 EUROPEAN MARKET

Europe's fishing production amounted to 8% of world production in 2004 (€4.7 billion). Within the EU, the UK, Spain, France and Denmark all have production valued at approximately €500 million each, although within the whole of Europe Norway is the clear leader, with an output three times the size at €1.49 billion in 2003. The expansion of the EU member states in 2003 has increased competition, but also increased the export market for Irish seafood.

A very high percentage of Irish exports are to the EU, although they declined by 10.2% from 2002 to 2003 (excluding fish landings at foreign ports – some of the Irish quota is landed in Norway where there are better prices and facilities for 24/7 offloading).[52] Meanwhile the domestic market experienced growth. 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.

[51] FAO, 'Projection of World Fishery Production in 2010'.

[52] 'BIM Annual Review', p8, 2003.

13.4 CHALLENGES

The fishing industry in Ireland is very fragmented with many small companies. These smaller companies are suffering with the increasing burden of legislation. In addition, cheap imports from the Far East into Europe have increased considerably and quotas are shrinking.

Foreign supermarkets within Ireland such as Aldi and Lidl are able to undercut Irish suppliers of processed fish products by 20%. Ireland has the additional disadvantage of being a day further from markets than other parts of Europe.

To secure regular export orders to international supermarkets, the Irish fisheries industry has to be able to supply the quantities on a regular basis, ideally with shipments six days per week, rather than the traditional one or two. International supermarket chains want to be provided with wide product lines that are QSP (Quality Seafood Product) labelled, such as salmon, smoked salmon and mussels.

13.5 THE LONG-TERM – 2010 ONWARDS

Future increases in demand for fish is expected to be met by 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, 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 for fisheries (including capture fishing and aquaculture):[53]

- Most growth will occur in developing countries which will account for 79% of production by 2020. China's share of production will grow whilst Japan, USA, EU and FSU contract.
- Fishmeal and oil prices will rise by 18% as these are increasingly concentrated into aquaculture.
- The share of aquaculture will increase worldwide.

[53]Delgado, C et al. Fish as Food, Projections to 2020.

14 Marine Aquaculture

	1999–03	2004	2005–09
Irish Market €M	496	111	623
UK Market €M	2,383	554	3,119
Europe Market €M	16,359	3,483	19,621
World Market €M	104,220	23,876	134,492

Definition – value of marine 'farmed' fish and shellfish as defined by the FAO.

14.1 INTRODUCTION

Due to the decline in global capture fishing, increasing consumer demand and the low prices of its products, aquaculture is the fastest growing sector in the food industry.[54] 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.) Between 1996 and 2002 annual average tonnage growth was 9% and growth in US$ terms 4% (FISHSTAT). Continuing strong future growth in demand is forecast. On a global basis investment in aquaculture will be critical in growing world fish output. There are opportunities for new species development and research opportunities in a number of areas.

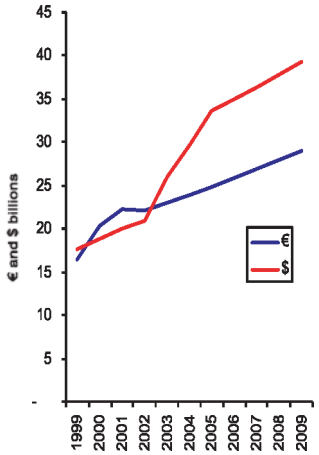
Environmental issues and scares have at times depressed demand but this quickly recovered. Norway leads European production and benefits from a strong international brand.

14.2 WORLD MARKET

Marine aquaculture production was valued at €24bn in 2004. With 70% of the world's production, Asia is the market leader. Asian production is valued at almost €17bn in 2004, much of which supplies their own domestic markets. Forecast data from 2003/4 onwards assumes a continuation of growth rate of marine aquaculture production value at 4% per year (based on historical dollar growth rate trends), reaching €29 billion by 2009. This trend is associated with aquaculture trying to fill the gap left by a decline in capture fishing and also due to the low price of its products (SE Asia is a low-cost high-volume producer). 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).

In the case of the US, seafood imports (both capture and aquaculture) have grown dramatically over the past decade and now represent 78% of all US seafood consumption. The US now has a negative seafood trade balance of $8bn annually.[55]

Figure 14.1: Marine Aquaculture – World Market



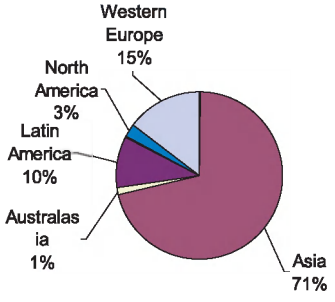
Source: Douglas–Westwood

Table 14.1: Marine Aquaculture – World Market

	1999–03	2004	2005–09
Africa	235	51	288
Asia	73,516	17,004	95,782
Australasia	1,223	302	1,700
E Europe/FSU	7	1	4
Latin America	9,489	2,317	13,054
Middle East	257	60	340
North America	3,133	657	3,702
Western Europe	16,359	3,483	19,621
TOTAL (€M)	104,220	23,876	134,492

Source: Douglas-Westwood

Figure 14.2: Marine Aquaculture – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[54] "The State of World Fisheries and Aquaculture 2002', SOFIA

[55] "Sea Technology", January 2005, p50.

14.3 EUROPEAN MARKET

Marine aquaculture production in Western Europe (€3.5 billion in 2004) is ranked second to Asia in regional production value (€17 billion), but this only amounts to a fifth of Asia's. According to available data, Eastern Europe's production is very small compared to Western Europe. As within the capture fisheries, Norway is the European leader by far with its production equal to the combined production of the UK, France and Spain. European production values are forecast to increase, in-line with global estimates, at a rate of 4% per annum from 2005 to 2009.

Total European (EU25) production grew by more than 40%, from 1 million tonnes in 1993 to 1.4 million in 1999, and then declined very slightly.[56] 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.)

Within Ireland a number of factors led to a decrease in salmon production from 21,423 tonnes in 2002 to 16,437 tonnes in 2003 (although trout farming was unaffected). This was due to company receiverships, market issues, disease and other unfavourable environmental factors. In addition, other countries are able to market the same products at reduced prices. Price battles among retailers are also contributing to the pressure to keep prices low – a situation that benefits consumers, whilst damaging suppliers.

14.4 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 of the article highlights how vulnerable the industry is to negative press. (There has been good development of Irish mussels since the bio-toxin issue was resolved.) 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.[57]

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

[56] 'Eurostat Yearbook' 2004

[57] 'Intrafish', December 2004, p15

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.

14.5 THE LONG-TERM – 2010 ONWARDS

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 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.

15 Seaweed

	1999–03	2004	2005–09
Irish Market €M	10	–	–
UK Market €M	–	–	–
Europe Market €M	–	–	–
World Market €M	28,490	5,988	32,746

Definition – value of farmed and harvested seaweeds as defied by the FAO.

15.1 INTRODUCTION

Today seaweed is used as food, food supplements, fertilizers, cosmetics and for medicinal preparations. The three main groups of commercial seaweed are red, brown and green and production is harvested from wild and cultivated sources, with the latter constituting the majority of the production.

15.2 WORLD MARKET

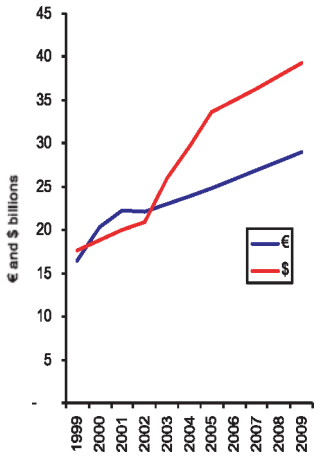
The value of the world seaweed market was almost €6 billion in 2004, over 90% of which was cultivated, the rest wild. Asia is responsible for the vast majority of this production, of which China and Japan are the main contributors. There is very high market demand in Asia and China's demand has outstripped the domestic supply, and has had to resort to importing from countries such as Korea. The farming of seaweed has expanded rapidly as demand has outstripped the supply available from natural resources. Commercial harvesting occurs in about 35 countries, spread between the Northern and Southern Hemispheres.[58] At the start of the reported period seaweed production was valued at €6.4 billion, then dipped in 2000, but the following years have all seen growth, with such value of production forecast to be reached again in 2006. Forecast annual growth 2005–2009 is estimated at 3%.

15.3 EUROPEAN MARKET

In Europe, seaweed aquaculture has only developed to any commercial extent in France where wakame is being grown for food, although this does not appear in international data. It is likely that more extensive seaweed aquaculture will become more widespread in Europe over the next two to three decades.

Ireland, with its extensive coastline, has a long history of seaweed use. Ireland's Atlantic seaboard in particular, is ideal for the settlement of seaweeds. Seaweed is the basis for an industry providing valuable employment in coastal areas that are geographically remote. Only a dozen or so larger species have been put to any commercial use.[59] Whilst there are not many companies actively involved in seaweed or sea vegetable cultivation in Ireland at present, the industry employs several hundred people, both part-time and full-time gatherers, plus those involved in the processing side. The value of production of the seaweed industry in Ireland (€9 million) does not figure in the Eurostat or Fishstat data, perhaps due to the relatively small size of the industry.

Figure 15.1: Seaweed – World Market



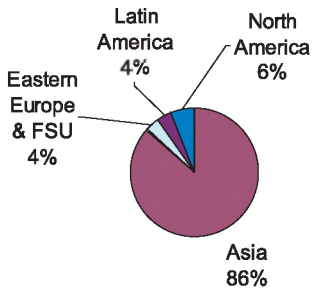
Source: Douglas–Westwood

Table 15.1: Seaweed – World Market

	1999–03	2004	2005–09
Africa	42	11	61
Asia	24,061	5,247	28,694
Australasia	66	13	72
E Europe/FSU	515	126	692
Latin America	879	235	1,283
Middle East	0	0	0
North America	2,898	351	1,919
Western Europe	31	4	24
TOTAL (€M)	28,490	5,988	32,746

Source: Historic Eurostat, forecast DWL

Figure 15.1: Seaweed – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[58] FAO: 'A guide to the Seaweed Industry' 2003.

[59] Morrissey J., Kraan S. & Guiry M.D., 'A Guide to Commercially Important Seaweeds on the Irish Coast', 2001.

15.4 CHALLENGES

The cultivation of seaweeds in Asia is fairly low-technology. Attached plants are placed in the sea and there is a high labour content in the operation. Several attempts have been made in various western countries to introduce high technology to the cultivation of detached plants grown in tanks on land to reduce labour content but none of these has become commercially viable to date.[60]

In Asia low labour costs married to simple and intelligent maricultural techniques have proved very successful. The labour intensiveness of seaweed mariculture and the absence of a ready market have been the main reasons why it has not developed to any great extent in the west. Political instability in such Asian countries might be the only way Europe could export to Asia. The Asian market expects high standards and without experience in these markets it might be difficult to achieve penetration.

15.5 THE LONG-TERM – 2010 ONWARDS

There is likely to be a long-term growth in demand for seaweed and seaweed products.

The ultimate development of seaweed cultivation is probably in the growth of genetically-improved strains with all environmental factors being controlled using biotechnological techniques.

The production of low volume-high value species with potential in the cosmetics, biopharma and neutraceutical areas will provide increasing business opportunities to the sector in Ireland. Specific initiatives in R/D will however be required to optimize cultivation methodology, to evaluate and to screen for bioactive compounds in the biomedicine and biotechnology areas.

[60] www.seaweed.ucg.ie

16 Seafood Processing

	1999–03	2004	2005–09
Irish Market €M	1,447	287	1,411
UK Market €M	6,721	1,232	6,152
Europe Market €M	48,671	8,241	40,901
World Market €M	466,254	79,859	384,878

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

16.1 INTRODUCTION

Processing is a growing activity, fuelled by an increasing 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. As the world population has increased, so has the demand for seafood products, with a greater percentage of people worldwide consuming seafood today than 20 years ago. Further, consumers are increasingly demanding consistent quality and availability of seafood at a reasonable price. Worldwide seafood demand is projected to increase over 60% as projected world population grows from 5.3 billion to 8.5 billion by 2025.[61] Worldwide demand for capture fisheries product is estimated at 110 million tonnes in 2010.[62] Our forecast suggests that the capture fisheries sector would only be supplying 74 million tonnes, although it is predicted that aquaculture production will increase during the forecast period.

There is a generally a lack of information available on this subject, broken down in any useful format, for the purposes of this report. Seafood processing revenues have been estimated as being equivalent to the combined marine aquaculture and fishing product value for each country. This view is based on data from a number of countries including Canada, Ireland and the UK.

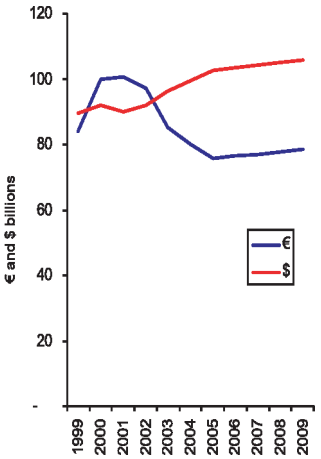
Our methodology is based on the concept that processing can add up to 100% to the overall value of the raw product. In other words, the market value is the production value of marine aquaculture plus the production value of marine capture fishing. This combined value correlates well with limited data found on countries' value of their processing industries.

Therefore, the forecast is based on the trends already defined by the fishing and aquaculture sectors (ie the availability of the raw product). It could be argued that there is a move towards more processing, with more value being added to the same amount of raw product as consumer demand increases. For the purposes of the report we have maintained the trends estimated for fishing and aquaculture production.

16.2 WORLD MARKET

In 2004 the seafood processing industry is estimated to be worth €80bn. Asia has the biggest proportion of activity, at over 60% of production, due in part to its large domestic seafood market. Historical and forecast values are based on the trends already defined by the fishing and aquaculture sectors (i.e. the availability of the raw product). As a result the industry is forecast to decline, from an historical peak, during the

Figure 16.1: Seafood Processing – World Market



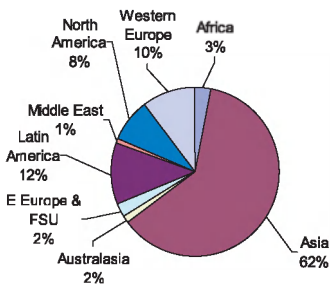
Source: Douglas–Westwood

Table 16.1: Seafood Processing – World Market

	1999–03	2004	2005–09
Africa	16,636	2,634	11,839
Asia	274,700	48,390	236,159
Australasia	7,323	1,240	5,898
E Europe/FSU	14,705	2,092	9,355
Latin America	58,187	9,720	46,162
Middle East	3,277	562	2,582
North America	42,756	6,980	31,981
Western Europe	48,671	8,241	40,901
TOTAL (€M)	466,254	79,859	384,878

Source: Douglas-Westwood

Figure 16.2: Seafood Processing – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[61] 'Aquaculture Research & Development Strategic Plan', United States Joint Subcommittee on Aquaculture.

[62] Feidi, I.H, October 1999, 'International Seafood Production & Trade to 2010. Where Are We Headed?'

reported period, of over €100 billion in 2001 (due mostly to exchange rate fluctuations) but towards the end of the period the impact in the increase of aquaculture production leads to a slight upturn, but not to levels previously reached. Forecast average annual growth for 2005–2009 is therefore still negative, but marginally at –0.4%. If displayed in dollars, then the processing sector would show steady growth throughout the forecast period (see table 16.1).

16.3 EUROPEAN MARKET

The European market is valued at €8.2 billion in 2004. 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 and processing can cut the value.[63] However, generally, value-added products are year by year taking a greater share especially within the chilled fish sector. From the available information, we estimate that within the EU, the UK has the largest processing industry, followed by Spain.[64] A considerable export market exists for processed seafoods. Norway's international sales have been greatly aided by the establishment and development of a premium brand. Obviously far more detailed analysis would have to be performed to ascertain individual countries' processing output accurately. As a result some individual countries' values may be inflated or deflated.

Challenges for smaller producers such as Ireland 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. The processing industry is an important employer in coastal communities within Ireland. Our estimates for Irish activity seem to correspond fairly closely with the BIM data. The Irish processing activity was worth €287 million in 2004.[65]

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

[63] Intrafish, 'Value Added Seafood Trends', November 11 2004.

[64] Eurostat

[65] Based on DWL estimates.

16.4 2010 ONWARDS – THE LONG-TERM VIEW

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.

17 Offshore Oil & Gas

	1999–03	2004	2005–09
Irish Market €M	478	114	483
UK Market €M	54,699	7,927	30,751
Europe Market €M	133,583	19,112	81,681
World Market €M	504,110	91,146	475,748

Definition – total capital and operational expenditure. (Not the value of the offshore oil & gas production which is considerably greater.)

17.1 INTRODUCTION

Some 35% of global oil production and 27% of gas production is from offshore. 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. Depletion of reserves in shallow waters (<500 m water depth) worldwide is causing the oil majors to move into deep water regions of the world such as Africa, Brazil and deepwater Gulf of Mexico where major fields are still to be found, with most future growth forecast for these regions. This move to deepwaters has resulted in the growing utilisation of floating production systems and subsea production technology at the expense of fixed platforms.

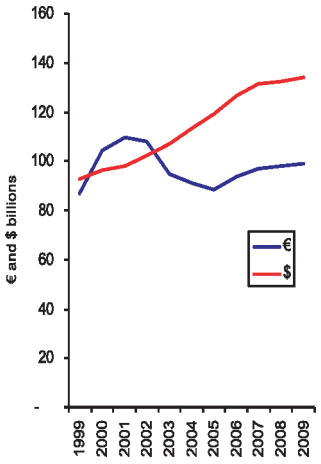
17.2 WORLD MARKET

Although offshore oil & gas is probably the world's largest marine industry in terms of the value of its output, as a market it is third largest after shipping and marine tourism. Its input cost (total expenditure) in 2004 is likely to be €91 billion. We expect this to grow to €99bn by 2009 and to be maintained at a similar level to 2012. 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. Average annual growth is forecast at 1.7% from 2005 to 2009. (It should be noted that values are given in 2004 prices at a time when high demand for services is inflating oil companies' costs.)

17.3 EUROPEAN MARKET

European expenditure was €19 billion in 2004. In 2005, Western Europe is expected to account for 20% of global offshore expenditure, however with production at its peak the region's share will decline to 15% by 2009. After nearly 40 years of production Europe is a mature region and is now entering an irreversible long-term decline. The North Sea has been the region of greatest activity over the past 30 years. 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. Ireland, with very few offshore fields, is forecast to continue to be a small producer unless there are some major discoveries; however, Irish and Irish-owned companies supply some niche technologies to a number of key foreign markets. Historic period spend for Western Europe, 1999–2003 was €134 billion, forecast to drop to €82 billion for the 2005–2009 period.

Figure 17.1: Offshore Oil & Gas – World Market



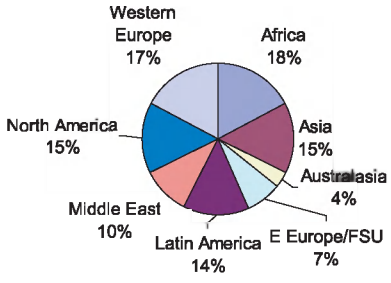
Source: Douglas–Westwood

Table 17.1: Oil & Gas – Expenditure Totals

	1999–03	2004	2005–09
Africa	54801	13202	81923
Asia	84243	14617	71616
Australasia	16749	3235	17430
E Europe/FSU	7755	3926	35024
Latin America	74037	12817	67662
Middle East	47251	9459	48483
North America	85691	14778	71930
Western Europe	133583	19112	81681
TOTAL (€M)	504110	91146	475748

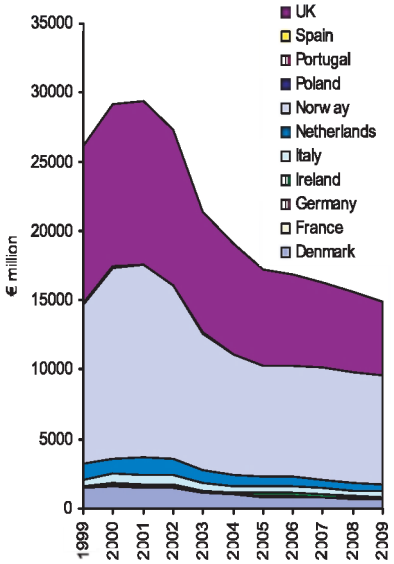
Source: Douglas-Westwood

Figure 17.2: Offshore Oil & Gas – Regional Segmentation 2005–2009



Source: Douglas–Westwood

Figure 17.3: Offshore Oil & Gas – European Expenditure



Source: Douglas–Westwood and EnergyFiles

17.4 OFFSHORE EUROPE

Two countries, Norway and the UK are forecast to account for 86% of European expenditure over the next five years, the remainder being mainly divided between Denmark, the Netherlands, Italy and Ireland.

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

17.5 IRELAND OFFSHORE

Ireland borders a large area of the north Atlantic margin including the Rockall Trough and the Porcupine Basin, due west of the Celtic Sea. However, there has been limited success with the only commercial production being from gas fields.

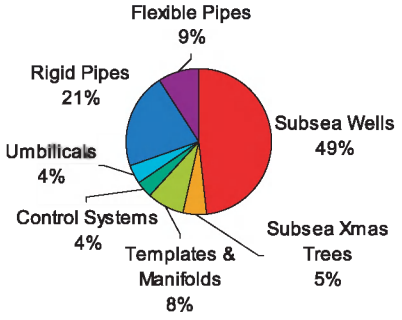
Three gas fields have been brought into production whilst one will begin producing in 2005. Marathon's Kinsale Head field came onstream in 1978 in the Celtic Sea and met Ireland's gas needs until 1996, when a pipeline was built to import gas from the UK. Kinsale Head and the nearby small Ballycotton field are in decline but this area has seen other small discoveries.

Ramco brought the Seven Heads field onstream in December 2003 using a five well subsea system tied back to the Kinsale Head A platform, where the gas is processed and exported through the existing pipeline to the Inch Terminal near Cork. Production peaked at 2.1 million cubic metres per day and in late 2004 production was restricted to 0.7 million cu m/d as the data was assessed.

The Corrib gas field was discovered in 1996 in 355m water depth in the Porcupine Basin some 80 km west of County Mayo. The field has eight planned subsea wells tied back to an offshore pipeline. Reserves are around 70% the volume of Kinsale. A processing terminal is planned in County Mayo. The field is expected to go into production in 2006–7.

The World Offshore Oil and Gas Forecast[66] suggests that it is fairly unlikely that further gas finds on a par with Kinsale Head and Corrib will be found and assumes that Ireland will reach peak gas output at around 2.8 Bcm per year (more than double 2004 rates) in 2006 and then slowly decline as additional smaller finds in the Celtic Sea are brought onstream. It is forecast that 1.9 Bcm will be produced in 2015. Although some small oil discoveries have been made in the Celtic Sea no oil production has been achieved from Ireland and none is forecast in the period of this report except for negligible amounts of condensate.

Figure 17.4: Subsea Field Development Costs



Source: Douglas–Westwood

17.6 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 over 6,400 estimated to have 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.

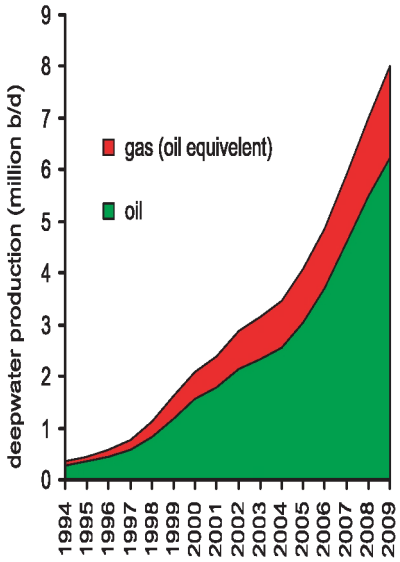
Where economics do not permit dedicated platforms, fields are often developed by wells completed on the seabed and 'tied back' (connected) to platforms. This is particularly the case for small fields and fields of all sizes in deepwater. In many instances, particularly in deepwater, subsea wells are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

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.

[66] Douglas-Westwood Limited, 2004.

Figure 17.5: Deepwater Oil & Gas Production



Source: The World Offshore Oil & Gas Report

17.7 DEEPWATER

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 of 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.

17.8 FLOATING PRODUCTION

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 tension leg platforms (TLP).

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

17.9 TECHNOLOGICAL CHALLENGES

There are many technological challenges facing the offshore industry. In common with other sectors, a key 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 deep water 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 therefore 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 of product to surface facilities need to be heavily insulated and/or heated and dynamic risers from floating production form a particular challenge.

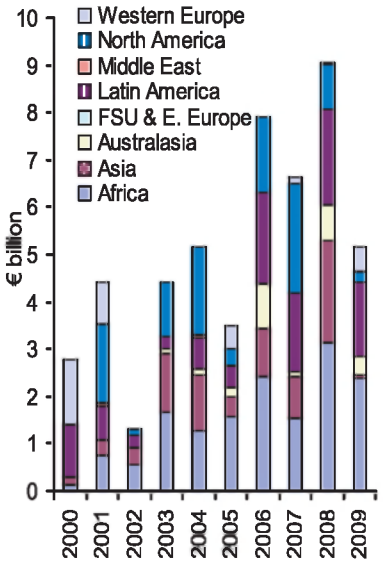
Subsea processing – the output of an oil well is a mixture of oil, gas and water and the latter increases over time. A major need is to extend the flow distances of unprocessed oil & gas by separating the product (on the seabed rather than on production platforms). An alternative is to develop pumping 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.[67] 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 that contains the oil & gas 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.

Figure 17.6: Floating Production Expenditure Forecast



Source: The World Floating Production Database

17.10 THE LONG-TERM – 2010 ONWARDS

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 deep waters.

It is forecast that after 2010 all offshore oil production growth will come from deep waters, 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.[68]

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 deep waters compared to 7% in 2004.

[67] "Optimisation revitilises brownfields' E&P, pp12-17 December 2004.

[68] "The World Offshore Oil & Gas Report", Douglas-Westwood Limited.

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. Global offshore Opex is forecast to continue increasing from €40bn in 2004 to €52bn in 2015 as total output grows, especially from more 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.

18 Marine Renewable Energy

	1999–03	2004	2005–09
Irish Market €M	46	–	255
UK Market €M	108	109	3,356
Europe Market €M	738	121	11103
World Market €M	741	128	12,649

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

18.1 INTRODUCTION

This sector is made up of expenditure on wind, wave and tidal installations. Currently a very small industry, the forecast for growth is huge.

18.2 WORLD MARKET

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 €5.6 billion by 2009, plus operating expenditure. Some 85% of forecast expenditure in the period 2005 to 2009 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.

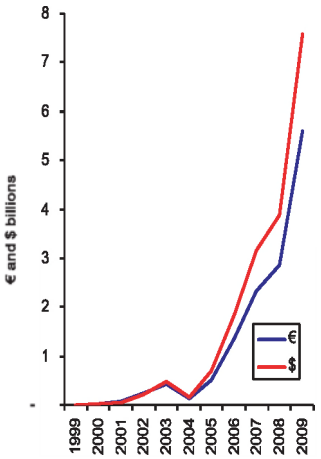
The industry is therefore beginning to move offshore where turbines are out of sight and have a better wind environment. There have been relatively few installations to date but major growth is forecast. We are at the beginnings of an important new industry.

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 2009. However, they have considerable long-term potential

18.3 EUROPEAN MARKET

Over the next five years, Douglas-Westwood forecast that Western Europe will account for 88% of global expenditure on marine renewable energy. Under present plans, Ireland would continue to be a very small producer with its share reducing due to strong growth in other countries' activities. However, the country's potential as a location for offshore renewable energy projects is considerable.

Figure 18.1: Marine Renewable Energy – World Market



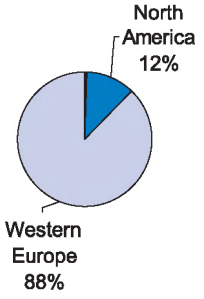
Source: Douglas–Westwood

Table 18.1: Marine Renewable Energy – Totals

	1999–03	2004	2005–09
Africa	0	0	0
Asia	1	0	20
Australasia	0	0	6
E Europe/FSU	0	0	50
Latin America	0	0	0
Middle East	0	0	0
North America	2	7	1470
Western Europe	738	121	11103
TOTAL ($M)	741	128	12649

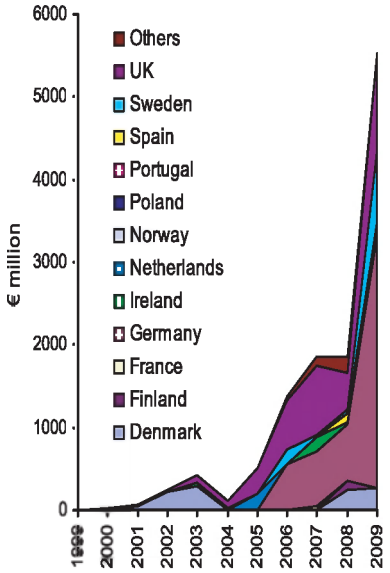
Source: Douglas-Westwood

Figure 18.2: Marine Renewable Energy – Regional Segmentation 2005–2009



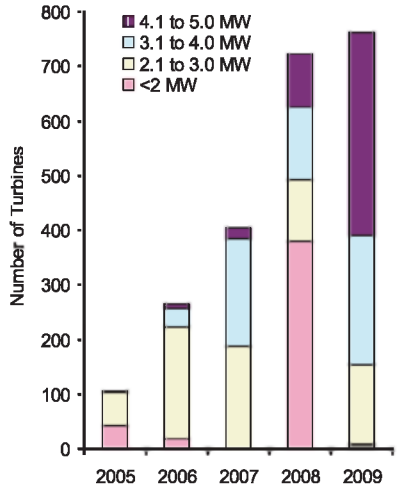
Source: Douglas–Westwood

Figure 18.3: Offshore Windpower – European Capital Expenditure



Source: Douglas–Westwood

Figure 18.4: Offshore Wind Turbine Size



Source: Douglas–Westwood

18.4 OFFSHORE WINDPOWER

There are 17 operational offshore wind farms worldwide. The 324 installed turbines in these projects provide a total of 605 MW. A total of 2,258 turbines are forecast to be installed between 2005 and 2009, a total of 7,500 MW.

The most recent project is the 60 MW Scroby Sands wind farm off the UK.

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 purchaser of equipment and services, with Germany taking the lead in 2009. The US 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.

Ireland has a relatively high number of project proposals. In the Alternative Energy Requirement competition AER VI round, two 25 MW projects (Kish and Bray Banks) were granted concessions. Both are under development by Saorgus Energy, and Hibernian Wind Power – owned by state company ESB. Scheduled start-up date is 2006. The 200 MW first phase of the 700 MW Codling Banks project, originally to begin construction by 2007, may be delayed to the end of the decade.

The 520 MW Clogher Head offshore wind farm off County Louth is under development by Airtricty. It is in two sections, one of which borders Northern Irish waters. The wind farm will generate electricity to both Ireland and Northern Ireland when it is commissioned, potentially by 2010.

18.5 TECHNOLOGICAL CHALLENGES

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 165 MW Nysted 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. Specialised vessels with 'legs' that lower to the seabed to give stability are used for installation.

18.6 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 short term outlook for these industries.

To give an example, in 2009, we 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.

Table 18.2: Electricity Generation Costs

Energy Type	€Cents/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

Source: The Royal Academy of Engineers March 2004

18.7 THE LONG-TERM – 2010 ONWARDS

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 table 18.2 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 cents/kWh.

Other studies by OXERA, for the UK government's Renewables Innovation Review, show that prices for onshore wind could drop to 3.9 cents/kWh by 2010.

Most of the new power generation capacity installed in Western Europe and many other countries in the past 20 years is fuelled by gas. However, the UK (and the US) are now facing gas supply shortages and although new foreign 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 gas price increases. We believe that the overall result of this will be to 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.

19 Minerals & Aggregates

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	3,008	672	3,648
Europe Market €M	5,761	1,344	6,938
World Market €M	11,746	2,741	14,149

Definition – value of aggregates and other minerals recovered from the seas.

19.1 INTRODUCTION

Marine production of minerals and aggregates has to date mainly been focused on the extraction of sand and gravel.

Marine aggregates are an important mineral source for industrial use and coastal restoration projects. Extraction activity is ongoing from several continental shelves including Japan (the largest producer), the UK (the second largest producer), the US, France, Denmark and the Netherlands. Reconnaissance of reserves has been carried out in Brazilian waters.

'Minerals & Aggregates' is dominated by the production of aggregates which are supplied to local markets in metropolitan areas together with supply to beach replenishment projects.

Offshore dredging reduces the need for onshore sand and gravel pits so bringing certain environmental benefits. However, concerns have been raised about the impact on the local marine environment with the result that the process tends to be confined to restricted areas.

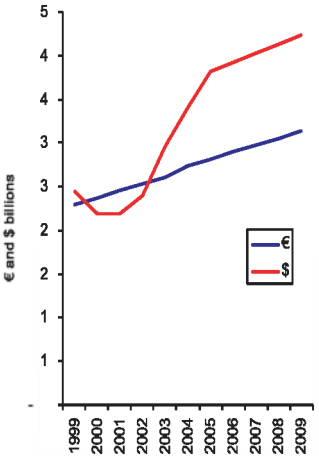
Other Minerals: The recent increases in demand for minerals and associated price increases have re-kindled interest in seabed 'mining'.

The much discussed development of exotic deepwater minerals such as manganese nodules and hydrothermal sulphides is prohibited by very high recovery costs. Methane hydrates, although strictly not a mineral, are receiving a high level of research interest worldwide.

The United Nations International Seabed Authority is continuing its work in attempting to regulate exploration for seabed minerals but has not yet presented a text for adoption.

Technology: Seabed 'mining' of exotic minerals both in deep and shallow waters offers future markets for subsea technology. The $30 million vessel MV Kovambo used off Namibia for subsea diamond dredging has a 160 tonne integrated seabed crawler, a new application of underwater vehicles. The UK-built crawler is the largest remotely controlled underwater vehicle (ROV) in the world. The mining company has also deployed a Danish autonomous underwater vehicle (AUV) to carry out seabed survey from the Kovambo.

Figure 19.1: Minerals & Aggregates – World Market



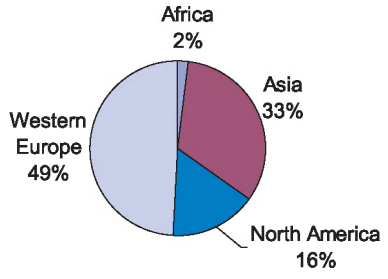
Source: Douglas–Westwood

Table 19.1: Minerals & Aggregates – World Market

	1999–03	2004	2005–09
Africa	225	53	273
Asia	3840	896	4626
Australasia	0	0	0
E Europe/FSU	0	0	0
Latin America	0	0	0
Middle East	0	0	0
North America	1920	448	2313
Western Europe	5761	1344	6938
TOTAL (€M)	11746	2741	14149

Source: Douglas-Westwood

Figure 19.2: Minerals & Aggregates – Regional Segmentation 2005–2009



Source: Douglas–Westwood

19.2 WORLD MARKET

The world value of the industry is estimated at €2.7 billion in 2004, with Japan being the largest producer. The sector is dominated by the production of aggregates which are supplied to local markets, with offshore dredging reducing the need for onshore pits so bringing environmental benefits.

Historically the sector has displayed steady growth through to 2004, from €2.3 billion in 1999. The forecast is for growth, with average annual growth of 2.7% leading to a value of €3.1 billion in 2009.

19.3 EUROPEAN MARKET

Within Europe, with the industry valued at €1.3 billion in 2004, the UK dominates, with the industry employing 2,500 people and extracted 22 million tonnes in 2003. Period growth is forecast from total value 1999–2003 of almost €6 billion to almost €7 billion during 2005–2009.

20 Shipbuilding

	1999–03	2004	2005–09
Irish Market €M	2	0	2
UK Market €M	1,001	234	928
Europe Market €M	63,913	13,143	52,076
World Market €M	183,440	37,746	155,017

Definition – total capital value of ships =>100GRT. Excludes naval vessels.

20.1 INTRODUCTION

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 so 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 imports of commodities 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.[69]

It is unlikely that such high economic growth rates can be sustained and in 2007–8 we expect a return to more normal activity levels as the new tonnage is absorbed by the market. As a result, many shipyards are not adding further capacity. Shipbuilders' profits have been hit by a combination of a large rise in steel prices and a fall in the US$. A result is that South Korean yards are reported to be targeting fewer orders in 2005.[70] For over a decade the prices of newbuilds has been on a downward trend. The 1990-based US$ index had fallen by 50%, mainly due to chronic overcapacity resulting from government subsidies, often attacked by the EU to little effect.[71]

A resumption of the lower long-term growth trend is, however, likely in the foreseeable future. From some $35 billion in 2000, we expect the total value of shipbuilding output to peak at around $45 billion in 2004–2006, and then fall to $39bn in 2008 before returning to its underlying long-term growth trend. However, as shown in an earlier chart, the recent major variations in the euro/dollar exchange masks this dollar market rise.

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.

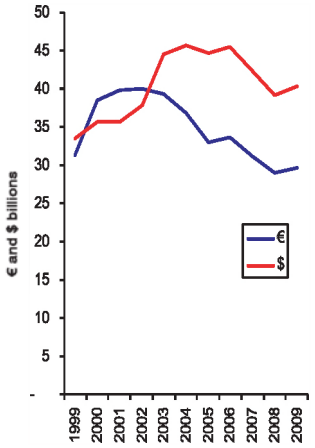
There has been a growth in average vessel size and we may well see 10,000+ TEU container vessels before 2008 but their numbers will be small.

[69] 'Lloyd's List' Annual Review 30 December 04.

[70] 'Lloyd's List' 5 January 2005, p1.

[71] 'Report from the Commission to the Council on the Situation in World Shipbuilding', Commission of the European Communities, 2003. http://europa.eu.int/comm/enterprise/maritime/

Figure 20.1: Shipbuilding – World Market



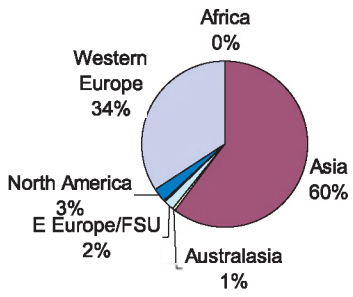
Source: Douglas–Westwood

Table 20.1: Shipbuilding – World Market

	1999–03	2004	2005–09
Africa	71	11	49
Asia	109,058	22,604	94,402
Australasia	985	174	804
E Europe/FSU	3,498	650	2,995
Latin America	493	97	446
Middle East	83	15	71
North America	5,339	1,052	4,174
Western Europe	63,913	13,143	52,076
TOTAL (€M)	183,440	37,746	155,017

Source: Douglas-Westwood

Figure 20.1: Shipbuilding – Main Regional Segmentation 2005–2009



Source: Douglas–Westwood

20.2 THE WORLD MARKET

The world shipbuilding sector is valued at almost €38 billion in 2004. 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".[72]

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".[73])

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 are 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, facilitated by its low labour costs and state investment. Past organisational problems and difficulties of access to technology have rapidly been 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. Today the SE Asian region dominates the delivery of tankers, bulk carriers and other large vessels that can be efficiently produced by 'industrial' shipbuilding techniques.

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.

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 lower-growth, long-term 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 impact on demand for shipbuilding is that 1,119 single hull tankers are, in

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

[73] "Sixth Report from the Commission to the Council on the Situation in World Shipbuilding" Commission of the European Communities, 13 November 2002.

theory, due to be phased out by the end of 2005.[74] The market shows future decline in euros (-4% annually 2005–2009) although this is not so significant in US dollars – the currency of the market.

20.3 EUROPEAN MARKET

Shipbuilding is an important and strategic industry in a number of EU Member States, with Europe's industry valued at €13 billion in 2004. 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 wide range of products, from large diesel engines to marine electronics.

According to the Association of Western European Shipbuilders and Shiprepairers (AWES), in 2003:

- The European industry provided 20% of the world shipbuilding capacity.
- Direct employment totals more than 129,000 jobs and the supply chain an additional 500,000.
- Average turnover of the shipbuilding is €14.4bn.
- Europe has a strong global position in complex vessels (64%) and ship repair (42%).
- The industry has a network of 9,000 sub-suppliers across Europe, mostly SMEs.
- 10% of turnover is spent on research, development and innovation through a high level of prototyping and the predominance of one-of-a-kind products.

In addition to shipbuilding, European ship repair and conversion was a business valued by the AWES at €2.2 billion in 2003. Germany is the largest player with a share of €553 million followed by the UK with €420 million.

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 ships used by the offshore oil & gas industry.

[74] 'Destination Unknown', European single hull tankers report. Greenpeace 2003.

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.

Although Ireland does not have a significant shipbuilding capability, it is necessary to understand the shipbuilding sector as it is a driver for others such as marine equipment, education & training, R&D, etc.

20.4 TECHNOLOGICAL CHALLENGES

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

20.5 THE LONG-TERM – 2010 ONWARDS

The long-term 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 US, to transfer road freight to short-sea shipping and this could result in an increase in orders for smaller vessels.

21 Marine Equipment

	1999–03	2004	2005–09
Irish Market €M	1	0	1
UK Market €M	571	133	529
Europe Market €M	94,741	16,675	73,263
World Market €M	355,826	72,871	358,315

Definition – value of equipment and materials purchased for commercial shipbuilding and oil & gas installations.

21.1 INTRODUCTION

Marine Equipment is a very large market and in this report we define it as being comprised of two main customer groups:

- Shipbuilding sector capital items (e.g. propulsion systems & machinery) total €21bn with over 5,000 suppliers listed worldwide.
- Oil & gas sector (e.g. production of platforms, pipelines, subsea equipment, etc) total €49bn and over 6,000 suppliers are listed worldwide.

One of the problems in valuing this sector is definitions. Many other smaller sectors such as offshore renewable energy could also be included; however, these are much smaller than oil & shipbuilding and would not make a significant difference to the totals. We specifically exclude military equipment.

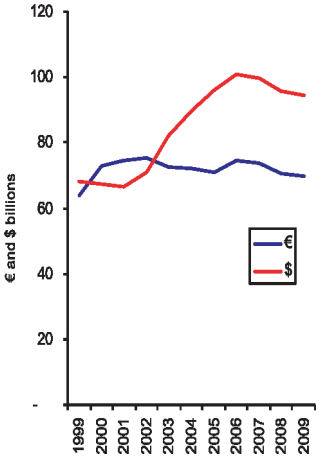
There is growing technology content in all sectors, with hundreds of high-tech sub-sectors ranging from software to underwater connectors to control systems and it is within these that the main opportunities for SMEs exist.

21.2 WORLD MARKET

As mentioned above, there is no clear definition of what constitutes marine equipment. Often it is regarded as bought-in items of the shipbuilding process such as propulsion systems and other machinery, the bridge systems, control and automation, but also extends to scuttles, washroom and galley equipment, etc. In our analysis we include all bought-in items. The world market for marine equipment in 2004 was €73 billion, marine equipment in the shipbuilding sector accounted for €21.3 billion of this.

Many definitions of 'marine equipment' only recognise the shipbuilding sector and exclude all others. The definition we use includes the capital expenditure item of the offshore oil & gas sector. In the oil & gas sector we use the capital expenditure component which we value at €49.7 billion in 2004. The segmentation of this expenditure by type of technology varies from region to region and also by water depth. Historically, the market was worth €64 billion in 1999. Since then, the sector has displayed slight fluctuations, but a general trend of growth, with forecast value of €70 billion for 2009, representing a slight decline of 0.6% annually from 2005 following a peak of €74 billion in 2006.

Figure 21.1: Marine Equipment – World Market



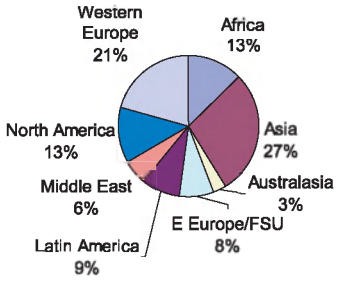
Source: Douglas–Westwood

Table 21.1: Marine Equipment – World Market

	1999–03	2004	2005–09
Africa	29,465	8,341	46,050
Asia	102,144	21,756	101,385
Australasia	9,989	2,124	11,557
E Europe/FSU	6,047	3,739	27,278
Latin America	37,857	6,147	32,588
Middle East	18,542	4,255	20,238
North America	57,061	9,834	45,956
Western Europe	94,721	16,675	73,263
TOTAL (€M)	355,826	72,871	358,315

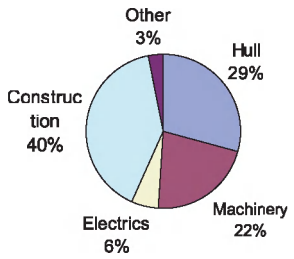
Source: Douglas-Westwood

Figure 21.2: Marine Equipment – Regional Segmentation 2005–2009



Source: Douglas–Westwood

Figure 21.3: Typical Ship Cost Segmentation



Source: Douglas–Westwood

21.3 EUROPEAN MARKET

Europe is a major provider of marine equipment, particularly high technology and was valued at €17 billion in 2004. In shipbuilding this ranges from electronic charting and integrated bridge systems to advanced marine engines.

In 2000, Europe was estimated to satisfy 37% of the world demand for shipbuilding sector marine equipment (whilst having only a 16% of the world shipbuilding market).[75] In 1997 the leading European suppliers of marine equipment were Germany 22%, UK 19% and Norway 15%.

In offshore oil & gas, Europe is again associated with high technology.

21.4 THE LONG-TERM – 2010 ONWARDS

The market was worth €64 billion in 1999. Since then the sector has displayed slight fluctuations, but a general rend of growth, with forecast value of €70 billion for 2009, representing a slight decline of 0.6% annually from 2005 following a peak of €74 billion in 2006. This is due to a forecast slight decline in shipbuilding. There is a growing technology content and hundreds of high-tech sub-sectors, many of which offer opportunities.

[75] '3rd report from the European Commission to the Council on the situation in world shipbuilding 2000'. (We assume this refers to ships equipment only.)

22 Marine IT

	1999–03	2004	2005–09
Irish Market €M	43	18	78
UK Market €M	648	217	917
Europe Market €M	3,794	1,382	5,872
World Market €M	9,780	3,570	16,012

Definition – IT hardware and software in all aspects of marine activities. (Excludes systems not designed for specialised marine applications – e.g. typical office software.)

22.1 INTRODUCTION

There are more than 500 suppliers of 'marine computing' worldwide (these are mainly SMEs, also there are many marine leisure sector players).

Marine IT is a subject that is difficult to assign precise boundaries to. IT hardware & software applies to, and is embedded in, all aspects of marine activity so is difficult to value. The major sectors are those associated with critical ship operations (e.g. integrated bridge), equipment support (e.g. engine management) and marine operations (e.g. cargo handling).

In addition there are many shore-based applications ranging from fleet management software to vessel traffic systems, and design software for various marine systems ranging from ships' hulls to dynamic risers for floating production systems.

In total, marine IT covers a very wide range of subject areas and systems including:

Critical IT – Navigation, Charting, Engine Management, Systems Management, Positioning, Communication, Loading/stability, Weather Forecasting and Ocean Modeling, Data Management.

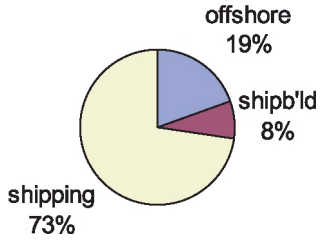
Non-critical IT – ISM Code Reporting, Accident & Injury Reporting, Cargo Transactions, Fuel Reporting, Bunkering Ops, Cargo Status Reporting, Crew & Payroll, Daily Log, Engineers Log, Invoices, Manifesting, Supplies, Equipment Performance Log, Equipment Procurement, Internet, Classification Reporting, Maintenance Management, Purchasing Management, Mail, Work Systems.

Other IT – Design, Build, Procurement.

Office-based software – VTMS, Brokering, Engineering Procurement, Crew management, Positioning/tracking, Accounting, Data Management, Fleet Management, Vessel Scheduling, Planning & Reservation.

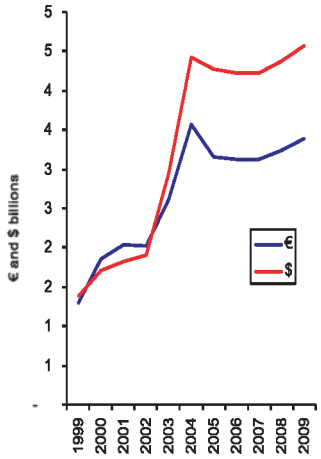
A significant barrier to development of marine IT has been the relatively high costs of high data rate satellite communications compared with onshore hard-wire or mobiles. Substantial improvements have been made but until broadband is successfully launched by Inmarsat in 2005/06, a bottleneck will remain. It is possible that the provision of internet services for the airline industry may speed up the process and reduce costs. Boeing are entering the maritime satellite communications market, challenging the historic dominance of Inmarsat.

Figure 22.1: Marine IT – Major Sectors



Source: Douglas-Westwood

Figure 22.2: Marine IT – World Market



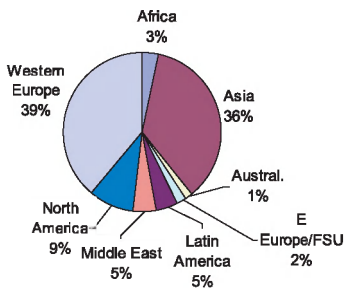
Source: Douglas–Westwood

Table 22.1: Marine IT – World Market

	1999–03	2004	2005–09
Africa	328	124	786
Asia	3,517	1,315	5,620
Australasia	129	43	224
E Europe/FSU	200	94	565
Latin America	466	140	742
Middle East	461	169	808
North America	885	304	1,396
Western Europe	3,794	1,382	5,872
TOTAL (€M)	9,780	3,570	16,012

Source: Douglas-Westwood

Figure 22.3: Marine IT – Regional Segmentation 2005–2009



Source: Douglas–Westwood

The previously unavailable Mobile Packet Data Service is to open up new levels of satellite communication to smaller vessels with the introduction of its capability into the Fleet 33 service from Inmarsat. Operating in a similar way to a GPRS mobile phone, the data connection is maintained constantly, resulting in users being charged only for the amount of data sent or received rather the time spent actually on line.

As in other IT sectors, there is a degree of consolidation ongoing as companies acquire other players in order to offer a range of applications.

22.2 WORLD MARKET

The very wide range of applications and lack of any official information on business activity in the marine sector means that it is difficult to value the market.

In order to develop a market value, we have assumed that the IT content of capital expenditure in three key areas of shipping operations (including IT additions to existing ships), newbuild ship capex, and the offshore oil & gas industry capex & opex averages 0.5% and this grows to 0.75% by 2004 and thereafter remains at this proportion.

For example, in the case of a €35 million medium size tanker this would equate to an IT value of €262,000. This may at first sight appear high, but the value is intended to include capital items on the vessel such as the IT content of bridge systems, communication systems, embedded engine control & management systems, safety and automation systems, etc., right down to the software packages used in the design of the vessel.

It may be argued that the IT content of other sectors could also be added, however, the values are much smaller than the three above, and that the IT content of the very large marine tourism sector is mainly shore-based conventional hotel/reservation management systems and not marine-specific.

On this basis, marine IT was valued at €3.6 billion in 2004. Historically marine IT has been growing substantially from €1.3 billion in 1999. There is an overall long-term increase in IT content in the marine sector. Globally, the sector is set for long term steady growth; however after a peak in 2004, annual growth is forecast at –0.9%, although period growth 2005–2009 is 7%.

22.3 EUROPEAN MARKET

Europe accounts for some 39% of the world market in 2004 (€1.4 billion), this is mainly due to the strong position in shipping, aspects of shipbuilding and the offshore oil & gas industry. As a result many of the significant players in the sector are European-based or owned.

These range from providers of electronic charting systems to specialist design software. It is likely that a significant percentage of European companies' revenues from marine IT are from export business. Forecast period growth is estimated, from €3.8 billion 1999–2003 to €5.9 billion 2005–2009.

22.4 TECHNOLOGICAL CHALLENGES

The main challenges ahead probably relate to the growth of low-cost manufacturing centres in China, India and Eastern Europe. These are already used by a number of European players with the result that local manufacturing jobs are being lost to regions such as SE Asia. The growing capability of companies in these areas and availability of graduate engineers at low cost probably means that design could also move there too.

22.5 THE LONG-TERM – 2010 ONWARDS

The continual need to improve efficiency of operations in all sectors of the marine industries will drive an increasing use of marine IT. Of particular significance will be the need to respond to increasing fuel costs and increases in automation, vessel tracking and security requirements and these will form the main focus for R&D.

The growing availability of affordable broadband communications will greatly improve the prospects for marine IT, by lowering cost of remote access to shore-based services and the rest of the 'wired-world'.

23 Marine Biotechnology

	1999–03	2004	2005–09
Irish market €M	–	–	–
UK market €M	–	–	–
Europe market €M	–	–	–
World market €M	11,350	2,190	11,848

Definition – the value of biotechnology products based on the use of marine organisms.

23.1 INTRODUCTION

80% of living organisms are found only in aquatic ecosystems, yet little is known about their biochemical characteristics. The marine biotechnology sector is in the early stages of its development with considerable interest being shown by the US, Japan, the UK and others. (It is arguable that at this stage in its development the Marine Biotechnology sector should be regarded as part of the R&D sector.)

Marine biotechnology offers considerable long-term potential which is mainly outside the timeframe of this report.

However, there have been some initial successes – the US Sea Grant has reported that with small investments five drugs have been developed "with market potential of $2bn p.a."

It is likely that the future marine biotechnology market should segment along similar lines to the established 'conventional' biotechnology market which is dominated by US companies (76% of global revenues followed by Europe 22%). However, the UK report referenced below implies that this may not be the case and that much more may be open to non-US companies.

A recent report commissioned by the UK's Foresight Marine Panel stated "With a global market valued at $2.4 billion in 2002, and a predicted growth rate exceeding 10% per annum over the next three years, there is no doubting that marine biotechnology represents one of the most exciting emerging technology sectors".[76]

The UK Foresight Report also stated: "Marine biotechnology is unlike other areas of biotechnology in that it is defined in terms of its source material, rather than the market it serves. It is anticipated that it will eventually contribute to nearly every industry sector, from healthcare to bioremediation and from cosmetics to nutraceuticals. The time to invest in the underpinning science, knowledge networks, and public understanding of this major biotechnology field has now arrived".

Examples of marine biotechnology are quoted in the UK report as follows:

- The potential for marine natural products as pharmaceuticals was first developed in the 1950s which led to two marine-derived pharmaceuticals that are still in use today. Ara-C is an anti-cancer drug (used against acute myelocytic leukemia and non-Hodgkin's lymphoma) and Ara-A used as an antiviral drug for treating herpes. Both these drugs were derived from natural compounds found in sponges off the

Note: Being an early-stage development there is insufficient information on which to base a regional segmentation.

[76] http://www.dti.gov.uk/marine_biotechnology_report.html

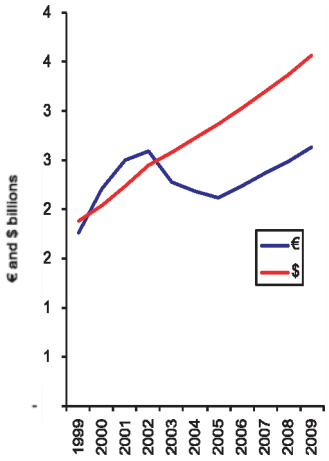
coast of Florida. Sponges have provided over 30% of the more than 5,000 chemical compounds derived from marine organisms to date.

- More recently, Vent DNA polymerase has been isolated from micro-organisms living around deep-sea hydrothermal vents. Polymerase Chain Reaction (PCR) is used to amplify very small amounts of DNA or RNA, and forms the basic process behind the gene mapping for the Human Genome Project. PCR requires enzymes that are stable at high temperature, precisely the conditions that the Vent DNA micro-organism has become adapted to.
- Nutraceuticals, or nutritional supplements, is a major growth area for the large pharmaceuticals companies. Marine microalgae are known to produce high levels of the fatty-acid, docosahexenoic acid (DHA) and arachidonic acid (ARA), both of which are found at high level in breast milk. Because these polyunsaturated fatty acids (PUFAs) have been linked to brain grey matter development, they are regarded as an important nutritional supplement, especially for infants. One such product, developed by Martek Biosciences in the US, is a market leader.

23.2 WORLD MARKET

In 2004 world production was valued at €2.2 billion. An earlier report describes the US marine biotechnology industry and the emerging market of marine biotechnology products and services. The global marine biotechnology market is projected to surpass €2.6 billion by 2009 with the non-US segment comprising the bulk of the market.[77]

Figure 23.1: Marine Biotechnology – World Market



Source: Douglas-Westwood

The UK Foresight Report gives a predicted growth rate "exceeding 10% per annum over the next three years" (from 2002). BCC Research in 2003 estimated average growth from 1999 to 2007 as:

USA	4.7%
Rest of World	6.4%
Total	5.9%

Over-estimation of market growth in the early years of technological development is a common failing, therefore in our forecasts we have chosen to use an average growth of 5.5% . (The 5.5% is the forecast in dollars. When exchange rates are applied, the Euro growth rate is 3.8%.) In our view it is likely that the anticipated very large market for marine biotechnology will develop outside the time period of this report. This makes marine biotechnology a very interesting long-term 'investment' prospect.

[77] http://www.bccresearch.com/biotech/C184R.html

23.3 EUROPEAN MARKET

As the sector is in the early-stages of development, there is insufficient information on which to base country or regional segmentation of data. 'Market' is rather a misnomer at this early stage of the development of marine biotechnology as the focus is firmly on research. The EU has funded some 75 projects in marine biotechnology. Although most countries have some level of activities, France and Germany are probably the most significant players, followed by the Netherlands, Ireland and Sweden.

Within the UK some 61 Higher Education Institutes are involved in researching and/or teaching marine sciences and of these 49 are involved in marine biotechnology or related research.

Of particular significance may be the UK's high level of development as a centre for conventional (land-based) biotechnology.

With annual sales of over $9.7 billion, the biotechnology industry in the UK is second in size only to the US. Along with some of the world's largest pharmaceutical multinational corporations, there are approximately 460 biotechnology companies, including consultant and service companies, working in this sector. An estimated 270 are dedicated biotechnology firms and 48 are publicly traded. Small and medium-sized biotechnology companies drive the industry as key sources of innovation.[78]

Biopharmaceuticals are the primary strength of the UK biotechnology industry, with an emphasis on genomics and gene therapy, combinatorial chemistry, regulation of cells, and development of transgenic animals. As much as 70% of all biotechnology companies focus on health care products.

The UK biotechnology industry is also characterized by clusters. Established to assist start-up companies and combine expertise to strengthen the industry, biotechnology clusters have become essential to industry growth. The clusters are located around academic centres of excellence, the main focal points being London, around Oxford, Cambridge and Scotland.

Key issues facing the UK marine biotechnology sector (and probably shared by others) are regarded as:

- Developing stable financial investment.
- Creating productive communication between the marine biotechnology community and the private and public sectors.

[78] http://atn-riae.agr.ca/europe/e3345.htm

- Delivering to the industrial sector development leads that are needed and for which they are willing to pay.
- Educating and training the people to make this possible.
- Promoting, marketing and positioning sector in a distinctive way.

23.4 THE LONG-TERM – 2010 ONWARDS

In 2002, Ernst & Young reported that there were 4,324 biotechnology companies worldwide with 188,703 employees, R&D expenditure of $16.4 billion and revenues of $35.8 billion. $25 billion of this was generated by US companies.[79] 'Invest in Japan' stated that the Japanese biotechnology market was worth $10.2bn in 2002.[80] These numbers seem disproportionate, but do serve to illustrate the size of the industry.

Considering that the oceans contain 80% of living organisms, it is reasonable to suggest that the long-term potential for marine biology must greatly exceed conventional land-based biotechnology revenue values.

[79] 'Refocus: The European Perspective Global Biotechnology Report 2004'. Ernst & Young.

[80] http://www.jetro.go.jp/usa/newyork/investinjapan/html/bio_overview.htm

24 Education & Training

	1999–03	2004	2005–09
Irish Market €M	–	–	–
UK Market €M	–	–	–
Europe Market €M	–	–	–
World Market €M	10,041	1,537	7,691

Definition – fees from higher education in marine subjects and training of marine personnel.

24.1 INTRODUCTION

Education & Training has three primary activities: seafarer training, offshore worker training and higher education (e.g. 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% over-supply of ratings although there are doubts about the extent to which large numbers of these ratings are qualified for international service.[81]

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 on board vessels worldwide. Russia is second with 7.3%.

Currently, 418 'maritime schools' are listed worldwide. In 2000, there were 121 maritime schools in the Philippines rapidly resulting in an over-supply of trained seafarers. However, in 2004 the number of schools was down to 76, twenty of which will be phased-out in the next two years, after their last students have graduated.

Of the 500,000 registered Filipino seafarers, enough to man most of the vessels afloat around the world, more than 300,000 are unemployed.

However, other countries are also adding training capacity – South Africa opened a 150 student training academy in 2003 offering two three-year courses.

Amongst training now being used are tools such as bridge and engine room simulators. Specialised courses for the fishing industry are offered by some establishments. In 2003, 1,681 attendances were registered in Ireland at the country's BIM Training Centres.

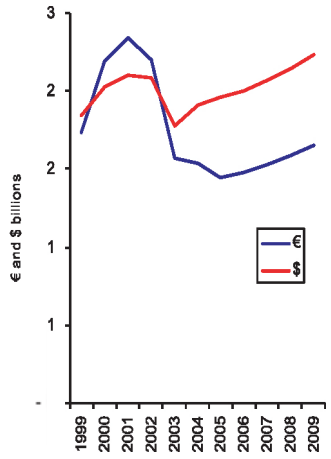
China and India are also significant maritime labour supply nations. Other major labour supply countries include Greece, Japan, Norway, Russia and the UK.

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.

Note: As training may be provided in one country to meet demand from other countries, it is difficult to segment the 'market' by regions. This is particularly the case for the shipping industry and to a lesser extent higher education.

[81] http://www.marisec.org/resources/2000Manpowerupdate .htm

Figure 24.1: Education & Training – World Market



Source: Douglas–Westwood

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 over 2005–9 a total of 177,000 personnel will need training.

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 a more demanding offshore environment than the Gulf of Mexico (from where the offshore industry originated) and its extensive use of helicopters for crew transfers. The need for even higher standards of safety and training was bought 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 all associated expenditure in this area as total operating costs of institutions often greatly exceed fees charged. In addition, it is difficult to clearly separate the education element of institutions' activities from research activities.

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

24.2 WORLD MARKET

The world value is estimated at €1.5 billion in 2004. Due in part to a recent over-supply of seafarers being trained, levels of activity have fallen slightly. This is due to be followed by a slight upturn with other areas within the sector seeing growth, resulting in annual average growth 2005–2009 of 1.5%.

25 Research & Development

	1999–03	2004	2005–09
Irish Market €M	325	62	329
UK Market €M	3,252	621	3,294
Europe Market €M	15,742	3,273	16,471
World Market €M	50,484	10,629	54,320

Definition – expenditure on R&D in all aspects of marine activities.

25.1 INTRODUCTION

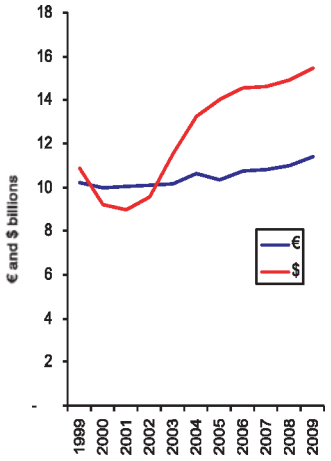
Research & Development relates to four main sub-sectors: shipbuilding, oil & gas, other industrial, and government (mainly academic). Our figures exclude the important military naval sector where the US accounts for €13bn and the world total could be €26bn. This is important to the civil sector, not 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, $564m for applied research, $677m for advanced technology development, $2.8bn for advanced components development and $8bn for system development and demonstration.[82] The US has a programme to specifically involve SMEs in military R&D.

25.2 WORLD MARKET

The Marine R&D sector is valued at €11bn for 2004. A number of sectors make up this global value. Historically, activity has been fairly constant with forecast growth estimated at 1.4% annually from 2005 through to 2009.

- 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 US. (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 US leads and we estimate NOAA's marine budget at €2bn. Other countries probably total €3 billion. The response to global warming is likely to increase this.

Figure 25.1: R&D – World Market



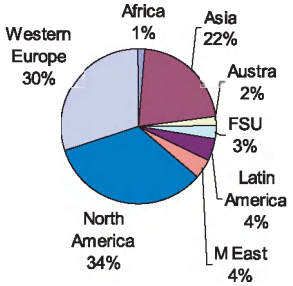
Source: Douglas–Westwood

Table 25.1: R&D – World Market

	1999–03	2004	2005–09
Africa	716	151	762
Asia	10,981	2,332	11,709
Australasia	1,083	225	1,163
E Europe/FSU	1,377	286	1,488
Latin America	2,184	445	2,368
Middle East	2,137	445	2,329
North America	16,266	3,472	18,030
Western Europe	15,742	3,273	16,471
TOTAL (€M)	50,484	10,629	54,320

Source: Douglas-Westwood

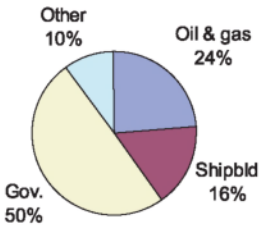
Figure 25.2: R&D – Regional Segmentation 2005–2009



Source: Douglas–Westwood

[82] 'Sea Technology Buyers Guide/Directory' 2005.

Figure 25.3: Marine R&D by Sector



Source: Douglas-Westwood

25.3 EUROPEAN MARKET

Europe's share of the world market was €3.3 billion in 2004 and is set to grow to €3.5 billion by 2009. "Research & Development (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 for the current decade: to make Europe the most competitive and dynamic knowledge-based economy in the world."[83]

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 US despite the Us'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."

Western Europe is responsible for a major part of world R&D activity, probably only second to the US. The majority of R&D expenditure in Europe comes from industry.

Offshore Oil & Gas – This has benefited from major research programmes in France, Norway and the UK, resulting in products and technologies sold worldwide. In the past considerable European Commission funding has been applied to programmes such as 'Hydrocarbons Research' with the aim of reducing dependency on OPEC oil supplies by development of 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.

However, production of oil & gas from Norway, is mainly by the Norwegian state oil companies, who have always invested heavily in R&D.

Nowadays, the main application of oil company R&D funds is in joint industry programmes (JIP) where they can access 100% of the results for a fraction of the cost. However, 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

[83] 'Eurostat Yearbook' 2004.

from depleting fields ('brown fields'). Within Scotland the government funded ITI Energy organisation 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 similar programmes operating in Norway and Brazil.

Shipbuilding – Fuel price increases have resulted in growing pressures to reduce vessel operating costs and the 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 (rather than 'true' R&D) for the special vessels that dominate European yards' production. Therefore in our estimates we use 5% of revenues.

Other Industries – Offshore renewables 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.

25.4 THE LONG-TERM – 2010 ONWARDS

The long-term drivers are well known:

- Global Warming
- Population Growth
- Demographic change
- The Developing Economies.

Major R&D challenges lie 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 – This 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 master's degree can be employed in India at 25% of the cost of an equivalent person in the US).

Offering to undertake R&D in a developing country is often seen as a way for an incoming company to deliver local content.

A challenge for Western governments will increasingly be how to anchor technology development in their own countries.

Notes

Notes

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