ΑΚΑΔΗΜΙΑ ΕΜΠΟΡΙΚΟΥ ΝΑΥΤΙΚΟΥ
Α.Ε.Ν ΜΑΚΕΔΟΝΙΑΣ

ΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ

ΘΕΜΑ:

IMPORTANT SHIPYARDS AROUND THE WORLD

ΕΠΙΒΛΕΠΩΝ ΚΑΘΗΓΗΤΗΣ: ΠΑΝΑΓΟΠΟΥΛΟΥ ΜΑΡΙΑ

ΤΟΥ ΣΠΟΥΔΑΣΤΗ: ΧΡΟΝΟΠΟΥΛΟΥ ΓΕΡΑΣΙΜΟΥ

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ABSTRACT

In the present project there is a reference to the early existance of the shipyards until today. A record is made about the prominent and the top shipyards,dockyards around the world. A mantion is given on the features of the shipyards and the influence of technology on them.

In the end there is a review on how shipbuilding industry affects the worldwide economy.

INTRODUCTION

A shipyard is a facility for building, maintaining, and repairing ships and boats which can vary in size from personal sailing boats to large container ships designed to travel around the globe. Usually, a shipyard is positioned in an advantageous location along a large inland river, harbor, or shoreline, and some historic shipyards have operated in the same location for hundreds of years. Numerous people work in a shipyard, including naval architects, engineers, electricians, and an assortment of other skilled tradespeople who contribute to the construction of a ship. A shipyard also has a large amount of specialized equipment.

At the most basic, a shipyard simply builds ships. However, most shipyards also maintain and repair ships that they have built, or ships caught in emergency situations which cannot return to their home shipyard. Typically, shipyards for civilian and military ships are kept separate, because of the security demands of the military, and the highly specialized ships built for most militaries. In either a civilian or a naval shipyard, the yard builds the ship from the ground up, creating the hull
and configuring the interior of the ship to the owner's specifications before launching it and fitting the ship out. In a military shipyard, the ships are often covered to prevent opposing militaries from gathering information about them.

Along with both dry and wet docks, a shipyard usually has an assortment of cranes for lifting ship components. In addition, a shipyard has large land-based slips to lay the keels for their ships, and to build up the hulls, along with enclosed dust free environments and areas set aside for painting. Multiple ships are usually being built at once, allowing visitors to see ships in various stages of completion and repair. When ships are complete, they are launched, fully fitted, and then delivered to their owners.

CHAPTER 1^{o}: HISTORY OF SHIPYARDS

The world's earliest known dockyards were built in the Harappan port city of Lothal circa 2400 BC in Gujarat, India. Lothal's dockyards connected to an ancient course of the Sabarmati river on the trade route between Harappan cities in Sindh and the peninsula of Saurashtra when the surrounding Kutch desert was a part of the Arabian Sea.

Lothal engineers accorded high priority to the creation of a dockyard and a warehouse to serve the purposes of naval trade. The dock was built on the eastern flank of the town, and is regarded by archaeologists as an engineering feat of the highest order. It was located away from the main current of the river to avoid silting, but provided access to ships in high tide as well.

The name of the ancient Greek city of Naupactus means "shipyard". Naupactus' reputation in this field extends to the time of legend, where it is depicted as the place where the Heraclidae built a fleet to invade the Peloponnesus.

In the Spanish city of Barcelona, the Drassanes shipyards were active from at least the mid-13th century until the 18th century, although it at times served as a barracks for troops as well as an arsenal. During its time of operation it was continuously changed, rebuilt and modified, but two original towers and part of the original eight construction naves remain today. It is currently a maritime museum.

Ships were the first items to be manufactured in a factory, several hundred years before the Industrial Revolution, in the Venice Arsenal, Venice, Italy. The Arsenal apparently mass-produced nearly one ship every day using pre-manufactured parts, and assembly lines and, at its height, employed 16,000 people.

❖ HISTORIC SHIPYARDS

- Lothal in Gujarat, India circa 2400 BC to 1900 BC
- Naupactus
- Roman shipyard of Stifone (Narni)
- Blackwall Yard 1614 to 1987
- Scotts Shipbuilding and Engineering Company, Greenock, Scotland, 1711–1984
- Kraljevica Shipyard established on 28 April 1729 and still operating yard
- Thames Ironworks and Shipbuilding Co. Ltd 1837 to 1912
- William Denny and Brothers, Dumbarton, Scotland 1840 to 1963
- John Brown & Company, Clydebank, Scotland 1851 to 1972
- Gdańsk Shipyard the birthplace of Solidarity Movement – (still a working yard)
- Swan Hunter – (closed in April 2006 and sold to Bharati Shipyards, India's second largest private sector shipbuilder)
- Harland and Wolff – (still a working yard)
- Cammell Laird – (still a working repair yard)
- Blohm + Voss, where the Bismarck was constructed (still a major yard)
- Havana, long the only dockyard in the Caribbean during the colonial period, the Santísima Trinidad, largest warship of its time, was built there in 1769.
- Royal Naval Dockyards in the UK (including Woolwich, Deptford, Chatham, Portsmouth and Devonport), Gibraltar, Bombay, Bermuda, Hong Kong and elsewhere worldwide
- Bethlehem Steel Corporation had 15 shipyards during World War II
    - Staten Island Shipyard 1895

- Charlestown Navy Yard, later Boston Navy Yard, Boston, Massachusetts 1800 to 1974
- Ulstein Verft, Norway, established in 1917 (still a working yard under the Ulstein Group)
- Navy Island, Ontario, Canada – French in the 18th century, then British 1763 to War of 1812
- Mare Island Naval Shipyard, Mare Island, California, 1854 to 1996
- New York Naval Shipyard (NYNSY), also known as the Brooklyn Navy Yard, the New York Navy Yard, and United States Navy Yard, New York 1801 to 1966
- Philadelphia Naval Shipyard 1799 to 1995, at two locations
- San Francisco Naval Shipyard, later Hunters Point Naval Shipyard, then Treasure Island Naval Station Hunters Point Annex, 1941 to 1994
- Potrero Point, San Francisco, California, 1880s – still a working yard
- Long Beach Naval Shipyard, 1943 to 1997
- Golden Horn Shipyard, (Haliç Tersaneleri), Turkey, established in 1455 – still a working yard
- Portsmouth Naval Shipyard, located on Maine-New Hampshire border; Operational: 1800 to present, making it the oldest continuously-operating shipyard of the US Navy.
- Chantiers de l'Atlantique(STX France) - established in 1861 (still a working yard

CHAPTER 2 : PROMINENT SHIPYARDS AND DOCKYARDS

❖ NORTH AMERICA

- Newport News Shipbuilding, (formerly Northrup Grumman Newport News) is the largest private ship builder in the US and the one best known for its unique capacity to build the *Nimitz*-class aircraft carriers.

- Ingalls Shipbuilding, part of Huntington Ingalls Industries, located in Pascagoula, Mississippi repaired the USS *Cole* and builds offshore drilling rigs, cruise ships and naval vessels.

- National Steel and Shipbuilding Company (NASSCO) shipyard in San Diego, California, part of General Dynamics; is the primary shipbuilding location on the west coast of the United States.

- Norfolk Naval Shipyard in Portsmouth, Virginia, is one of the largest shipyards in the world, specializing in repairing, overhauling and modernizing naval ships and submarines. It's the oldest and largest industrial facility that belongs to the United States Navy

- Electric Boat Division (EBDiv) of General Dynamics in Groton, Connecticut with an accessory facility in Quonset Point, Rhode Island, builder of many Naval submarines over the past 100 years, with some types built only here.

- Bath Iron Works (BIW), subsidiary of General Dynamics, is a major American shipyard located on the Kennebec River in Bath, Maine.

- Puget Sound Naval Shipyard in Bremerton, Washington, is also owned by the U.S. Navy. It services ships and submarines from the West Coast.

- The Portland, Oregon shipyard, operated by Cascade General Ship Repair (which is owned by Vigor Industrial)[1] is the largest such facility on the United States West Coast.

- The Louisiana Port is along the Mississippi river. It involves the Bollinger company in St. Rose.

❖ SOUTH AMERICA

- The DIANCA shipyard in Puerto Cabello, Venezuela.

- SCRA (Construction Refurbishment and Armament Service) with two dry docks, ready for naval and general vessel works.
  - Punta de Lobos (Wolves Point) in west Montevideo, established in 1874.
  - Punta Maua (Maua Point) in east Montevideo, established in 1872.

- Tsakos Industrias Navales S.A.

- Talleres Navales del Golfo SA de CV in Veracruz, Mexico. A member of the Hutchison Port Holdings Group

- Cotecmar shipyard in Cartagena, Colombia. Cotecmar

- Enseada Industria Naval S.A., Bahia and Rio de Janeiro, Brazi

❖ EUROPE

- BAE Systems Surface Ships operates three shipbuilding yards in the United Kingdom; Portsmouth, England and Scotstoun and Govan on the River Clyde in Glasgow, Scotland. Major projects include the Type 45 destroyer and the *Queen Elizabeth* class aircraft carriers.

- BAE Systems Submarine Solutions operates a major shipyard at Barrow-in-Furness in Cumbria, England. It is one of the few yards in the world capable of building nuclear submarines such as the Royal Navy's *Vanguard* class. This division has built surface ships in the past and will manufacture blocks of the *Queen Elizabeth* class.

- Fincantieri - Cantieri Navali Italiani S.p.A.[5] is an Italian shipbuilding company based in Trieste, Italy. It was formed in 1959 and is the largest shipbuilder in Europe, and one of the largest in the world. The company has built both commercial and military vessels during its history.

- Lürssen is a German shipbuilding company based in Bremen-Vegesack. Lürssen designs and constructs yachts, naval ships and special vessels. Trading as Lürssen Yachts, it is one of the leading builders of custom superyachts.

- The Meyer Werft GmbH is one of the major German shipyards, headquartered in Papenburg at the river Ems. Founded in 1795 and starting with small wooden vessels, today Meyer Werft is one of world´s leading builders of luxury passenger ships. Altogether about 700 ships of different types have been built at the yard.

- Navantia is a Spanish shipbuilding firm, which offers its services to both military and civil sector. It is the fifth largest shipbuilder in Europe, and the ninth largest in the world with shipyards all over Spain. It is located at Ferrol.

- Devonport Dockyard, located in the city of Plymouth, England in the county of Devon is the largest naval base in Western Europe. It has 15 dry docks, four miles (6 km) of waterfront, 25 tidal berths, five basins and covers 650 acres (2.6 km²). It is the main refitting base for Royal Navy nuclear submarines and

also handles work on frigates. It is the base for seven of the Trafalgar class nuclear-powered hunter-killer submarines and many frigates, exploiting its convenient access to the Atlantic Ocean. It supports the Vanguard class Trident missile nuclear ballistic missile submarines in a custom-built refitting dock. It houses HMS *Courageous*, a nuclear-powered submarine used in the Falklands War and open to the general public.[6] Facilities in the local area also include a major naval training establishment and a base for the Royal Marines.

- Chatham Dockyard, located on the River Medway in Kent, was established as a royal dockyard by Queen Elizabeth I in 1567. For 414 years, the Dockyard provided over 500 ships for the Royal Navy, and was forefront of shipbuilding, industrial and architectural technology. At its height, it employed over 10,000 skilled artisans and covered 400 acres (1.6 km²). The dockyard closed in 1984, and most of the Georgian dockyard is now managed as a visitor attraction by the Chatham Historic Dockyard Trust.

- Sobrena in Brest, France. It operates 3 drydocks, up to 420 by 80 metres.

- ROUSSE SHIPYARD WEST. The yard is located at the city of Ruse, Bulgaria, along the Danuve river. It is specialised in shipbuliding, shiprepair and manufacture of metal constructions. The yard owns the following main facilities: two piers with total length 605 meters; 14 buildling berths, 6 of which covered; traveling platform for shifting of the vessels; launching arrangement with capacity 1800 tons; additional floating arrangement for launching of vessels with weight up to 2200 t; covered production area of 69 decares including: cutting workshop, section assembly workshop, technical workshop, assembly workshop, pipe workshop and outfitting and delivery Department. The capacity of the yard allows building of vessels with the following dimensions: Length - 140 m; Breadth - 17 m; Deadweight - up to 8000 tdw.

❖ EAST ASIA

- Kawasaki Shipbuilding Corporation's Kobe Shipyard & Machinery Works in Japan builds oil tankers, LNG carriers, bulk carriers, container ships, Ro/Ro vessels, jetfoils and warships for the Japan Maritime Self-Defense Force

- Mitsui Engineering & Shipbuilding's Tamano Works builds bulk carriers, ore carriers, crude oil tankers, oil product carriers, LNG carriers, LPG carriers, reefers, container ships, pure car carriers, cargo ships, patrol vessels, ocean surveillance ships, training vessels, fishery patrol boats and fishing boats

- Mitsubishi Heavy Industries's Nagasaki Shipyard & Machinery Works primarily produces specialized commercial vessels, including LNG carriers, oil tankers and passenger cruise ships

- Hyundai Heavy Industries Ulsan Shipyard & Gunsan shipyard, in South Korea, is currently the largest in the world and has the capability to build a variety of vessels including Commercial Cargo, FPSO offshore, container ship, LNG Carrier,Car carriers, Tankers like VLCC & ULCC, Iron ore carrier and Naval vessels like Aegis destroyers & submarines.

- Hyundai Samho Heavy Industries Samho shipyard near Mokpo 4th largest South Korean shipyard for VLCC Oil tankers, container ships & LNG, Offshore, Subsidiary of Hyundai heavy industries.

- Hyundai Mipo dockyard, Ulsan bay shipyard chemical ships, LPG carriers, Special ships. Subsidiary of Hyundai Heavy Industries

- Yantai Raffles Shipyard, in Yantai, China, is that country's largest offshore builder. It employs the 20,000 ton crane Taisun, the holder of the Heavy Lift World Record. Yantai Raffles' portfolio includes offshore platforms, pipe lay and other specialized vessels.

❖ SOUTH EAST ASIA

- Keppel Shipyard(Singapore)
- Jurong Shipyard Pte Ltd (Singapore)
- Hanjin shipyard in Subic, Zambales, Philippines
- Selat Melaka Shipbuilding Corporation (Malaysia)
- PT Surya Prima Bahtera Heavy Industries, in Batam, Indonesia.
- The Bangkok Dock Company Sattahip, Thailand
- Marsun Company Limited (MCL) Samutprakarn, Thailand
- Marine Acme Thai Dockyard (MAT) Samutprakarn, Thailand
- Bason Shipyard, in Ho Chi Minh City, Vietnam, is a long-standing builder that was established by the French government in April, 1863 to repair warships and merchant vessels. Aside from its main function of building and repairing naval vessels, Bason also offers service to local and foreign customers from Southeast Asia and Europe.

❖ SOUTH ASIA AND THE MIDDLE EAST

- Western Marine Shipyard, a leading shipyard in Bangladesh based in Chittagong. The shipyard has been exporting ships and vessels to a number of European, Asian and African countries.

- Khulna Shipyard is the oldest shipyard in Bangladesh, situated in Khulna. It mainly produces warships for Bangladesh Navy.

- Ananda Shipyard and Shipways, one of the largest shipyards in Bangladesh, located in Narayanganj. It is a 100% export oriented shipyard.

- Pipavav Shipyard in Gujarat, India, is the leading, modern and largest engineering facility in the business of ships and offshore platforms construction, repair and conversion, heavy engineering and offshore engineering in South Asia.

- Colombo Dockyard in Colombo, Sri Lanka, is the largest engineering facility in the business of ship repair, shipbuilding, heavy engineering and offshore engineering in Sri Lanka

- NorthStar Shipbuilding Pvt Limited[15] in New Mumbai, India, is one of the leading shipyard in India for small and mid-size ships.

- Sulkha Shipyard[16] builds a wide variety of ships. It has been in operation for 500 years.

- Cochin Shipyard in Kochi, India, is that country's largest shipyard. It is building the Vikrant class aircraft carrier.

- Garden Reach Shipbuilders and Engineers is located in India. It is owned by the Government of India and is constructing the Shardul class Large landing ship tank for the Indian Navy.

- Karachi Shipyard and Naval Dockyard in Karachi, Pakistan, is that country's first and oldest yard. It constructs cargo ships, tugboats, support vessels, and warships.

- Mazagaon Dockyard, operated by state-owned Mazagaon Dock Limited, is one of India's largest shipyards. It constructs a variety of ships both for the defence and civilian sector. The dockyard is known for constructing Britain's HMS *Trincomalee*.Currently the shipyard is building three Shivalik class frigates and three Kolkata class destroyers for the Indian Navy.

- The beach at Alang in the Indian state of Gujarat is the site of a large complex of shipbreaking yards. In 2010, the yard dismantled 357 ships; on average the yard processes 28-30 ships a month.

- The Jebel Ali and Dubai ports in the UAE are capable of handling, constructing and repairing large ships. They also provide dry dock facilities.

CHAPTER 3 : SHIPBUILDING AND SHIP REPAIR

❖ WORLDWIDE SHIPBUILDING INDUSTRY

After the Second World War, shipbuilding grew as an important and strategic industry in a number of countries around the world.

This importance stems from:

- The large number of skilled workers required directly by the shipyard, along with supporting industries such as steel mills, railroads and engine manufacturers; and
- A nation's need to manufacture and repair its own navy and vessels that support its primary industries

Historically, the industry has suffered from the absence of global rules and a tendency towards (state-supported) over-investment due to the fact that shipyards offer a wide range of technologies, employ a significant number of workers, and generate income as the shipbuilding market is global.

Shipbuilding is therefore an attractive industry for developing nations. Japan used shipbuilding in the 1950s and 1960s to rebuild its industrial structure; South Korea started to make shipbuilding a strategic industry in the 1970s, and China is now in the process of repeating these models with large state-supported investments in this industry. Conversely, Croatia is privatising its shipbuilding industry.

As a result, the world shipbuilding market suffers from over-capacities, depressed prices (although the industry experienced a price increase in the period 2003–2005 due to strong demand for new ships which was in excess of actual cost increases), low profit margins, trade distortions and widespread subsidisation. All efforts to address the problems in the OECD have so far failed, with the 1994 international shipbuilding agreement never entering into force and the 2003–2005 round of negotiations being paused in September 2005 after no agreement was possible. After numerous efforts to restart the negotiations these were formally terminated in December 2010. The OECD's Council Working Party on Shipbuilding (WP6) will continue its efforts to identify and progressively reduce factors that distort the shipbuilding market.

Where state subsidies have been removed and domestic industrial policies do not provide support in high labor cost countries, shipbuilding has gone into decline. The British shipbuilding industry is a prime example of this with its industries suffering badly from the 1960s. In the early 1970s British yards still had the capacity to build all types and sizes of merchant ships but today they have been reduced to a small number specialising in defence contracts, luxury yachts and repair work. Decline has also occurred in other European countries, although to some extent this has reduced by protective measures and industrial support policies. In the U.S.A, the Jones Act (which places restrictions on the ships that can be used for moving domestic cargoes) has meant that merchant shipbuilding has continued, albeit at a reduced rate, but such protection has failed to penalise shipbuilding inefficiencies. The consequence of this is that contract prices are far higher than those of any other country building oceangoing ships.

❖ PRESENT DAY SHIPBUILDING

China is an emerging shipbuilder that overtook South Korea during the 2008-2010 global financial crisis as they won new orders for medium and small-sized container ships. China is now firmly the world's largest shipbuilder with 45% of the world's total orders, and its quality and technology have improved very much.

Today, South Korea is the world's second largest shipbuilding country with a global market share of 29% in 2012. South Korea leads in the production of large vessels such as cruise liners, super tankers, LNG carriers, drill ships, and large container ships. In the 3rd quarter of 2011, South Korea won all 18 orders for LNG carriers, 3 out of 5 drill ships and 5 out of 7 large container ships. South Korea's shipyards are highly efficient, with the world's largest shipyard in Ulsan operated by Hyundai Heavy Industries slipping a newly built, $80 million vessel into the water every four working days. South Korea's "big three" shipbuilders, Hyundai Heavy Industries, Samsung Heavy Industries, and Daewoo Shipbuilding & Marine Engineering, dominate global shipbuilding, with STX Shipbuilding, Hyundai Samho Heavy Industries, Hanjin Heavy Industries, and Sungdong Shipbuilding & Marine Engineering also ranking among the top ten shipbuilders in the world. In 2007, STX Shipbuilding further strengthened South Korea's leading position in the industry by acquiring Aker Yards, the largest shipbuilding group in Europe. (The former Aker Yards was renamed STX Europe in 2008). In the first half of 2011, South Korean shipbuilders won new orders to build 25 LNG carriers, out of the total 29 orders placed worldwide during the period.

Japan had been the dominant ship building country from the 1960s through to the end of 1990s but gradually lost its competitive advantage to the emerging industry in South Korea which had the advantages of much cheaper wages, strong government backing and a cheaper currency. South Korean production overtook Japan's in 2003 and Japanese market share has since fallen sharply.

The Philippines has placed fourth among shipbuilding nations around the world producing more than six million deadweight tonnes of ships built in 2012. The country is anchored by South Korean Hanjin and Japan's Tsuneishi shipbuilders. The country has shipyards in Subic and Cebu.

The market share of European ship builders began to decline in the 1960s as they lost work to the Japanese in the same way as Japanese builders have lost work to South Koreans more recently; Europe's production is now a tenth of South Korea's and is primarily military, although cruise liners and some cargo ships are still built in Italy, Finland, France, Germany and Denmark. The largest shares of the European shipbuilding market belong to Germany, Italy, Norway, the Netherlands and Spain, which accounted in 2010 for over 70% of total deliveries by the yards. This activity accounted in 2010 for 1.5% of European GDP. Over the four years from 2007, the total number of employees in the European shipbuilding industry declined from 150,000 to 115,000. The output of the United States also underwent a similar change.

World shipbuilding market share by countries (2012)			
RANK	COUNTRY	COMBINED GT	%
1	China	67,000,000	45%
2	South Korea	53,000,000	29%
3	Japan	28,000,000	18%
4	European Union	4,500,000	1%
5	Rest of the world	11,000,000	7%

❖ SHIP REPAIR INDUSTRY

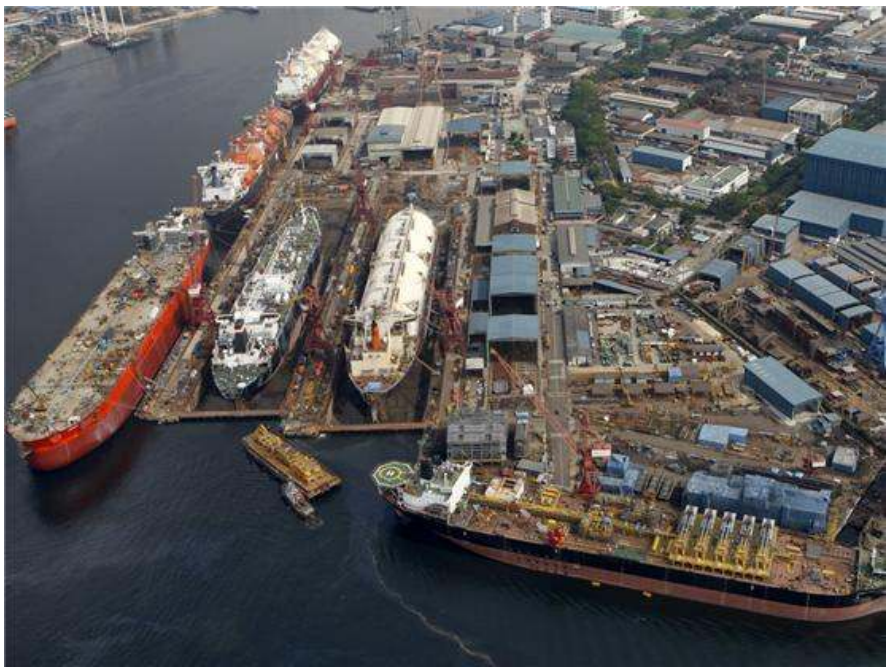
All ships need maintenance and repairs. A part of these jobs must be carried out under the supervision of the Classification Society. A lot of maintenance is carried out while at sea or in port by ship's staff. However a large number of repair and maintenance works can only be carried out while the ship is out of commercial operation, in a Shiprepair Yard. Prior to undergoing repairs, tankers must dock at a Deballasting Station for completing the tank cleaning operations and pumping ashore its slops (dirty cleaning water and hydrocarbon residues)

CHAPTER 4 : TOP 10 SHIPBUILDING COMPANIES IN THE WORLD

The shipbuilding industry is recognised as one of the most profitable industries around the world.

In spite of the recent financial slump, the introduction of new marine equipment for green ships and the rise in the level of sustainability along with innovation has put the shipbuilding sector among the top ranks in the global competition arena.

As ships are the key mode of transportation for countries around the world, the shipbuilding sector forms an integral part in the development of nations.



Moreover with the recent increase in demand of cargo and passenger ships, the requirement for economical and greener ships has also elevated. The future ships under development are sure to change a lot in the shipping industry.

All shipyards around the world are making their own efforts to deliver ships which meet the demand of shipping regulating authorities of being sustainable, energy efficient, and eco-friendly.

The top shipbuilding companies around the world have recognized this need and have excelled in this area and have thus evolved as the biggest productive shipyard in the world.

Top 10 Shipbuilders in the world in terms of Gross Tonnage :

1. *Hyundai Heavy Industry – Ulsan, South Korea*

The Leader in the Shipbuilding sector, Hyundai Heavy Industry is based on Ulsan with a record of 93,893,700 GT which includes 1428 ships of various types and sizes.

2. *Daewoo Shipbuilding – Okpo, South Korea*

Another giant in this sector and second in the world is Daewoo Shipbuilding, located in Okpo and known for its sustainable and giant ships. The future delivery includes much talked about Maersk EEE class vessels. The total production of Daewoo shipyard is 68,284,087 GT which includes 834 ships.

3. *Samsung Heavy Industry – Geoje, South Korea*

Samsung H I shipbuilding company is one of the top three shipbuilders in the world with specialisation of special purpose vessels like FPSO, LNG etc. The total Gross tonnage production till date is 58,082,349 GT which includes 785 ships.

4. *Hyundai Samho – Samho, South Korea*

Another Key player from Korea, Hyundai Samho is located in Yeongam with production capacity of approximately 40 vessels per year. The Gross tonnage production till date is 28,414,515 GT which includes 372 ships.

5. *Mitsubishi Heavy Industry – Nagasaki, Japan*

Second in rank within Japan and 5th in the world, Mitsubishi H I has its specialization in commercial vessels such as oil tanker and cruise ships. The total gross tonnage production till date is 19,506,548 GT which includes 315 ships.

6. *Tsuneishi shipbuilding – Numakuma, Japan*

Tsuneishi is the leading shipbuilding company in Japan with specialisation in building medium sized Bulk carrier ships. The Gross tonnage production till date is 17,824,038 GT which includes 492 ships.

7. Oshima Shipbuilding – Oshima, Japan

Oshima Shipbuliding has a specialisation in building bulk carrier ships with gross tonnage production till date of 16,983,004 GT which includes 539 ships.

8. Hyundai Mipo – Ulsan, South Korea

One of the most versatile production house in terms of conventional and specialised vessels, Hyundai Mipo is famous for delivering mid size chemical tanker and Panamax container ships. The Gross tonnage production till date is 16,715,650 GT which includes 618 ships

9. Imabari Shipbuilding – Marugame, Japan

Imabari Shipyard built the world first vehicle Carrier –"American Highway" and has delivered VLCC of 300,000 DW. The Gross tonnage production till date is 15,692,687 GT which includes 393 ships.

10. Shanghai Waigaoqiao – Shanghai, China

Shanghai Waigaoqiao shipyard is the number one shipbuilding company in China with the total gross tonnage production until date of 15,096,900 GT, which includes164 ships of various types and sizes.

CHAPTER 5 : Technologies That Can Change The Future of Shipbuiling

Advancement in technology is key to the development of any industry. The shipbuilding industry is no exception. In fact, shipbuilding is changing at a rapid rate taking advantage of highly advanced technologies which aim to solve the issues such as environmental pollution, rising fuel costs etc.
Riding high on R&D activities, the shipping industry has developed some potentially revolutionary technologies. Mentioned below are seven important technologies which might help to change the future of shipbuilding.

1) **3-D Printing Technology** : The 3D printing technology makes it possible to construct real objects from virtual 3-D objects. This process is carried out by cutting virtual object in 2-D slices and printing the real one slice by slice. There have been invented several 3-D printing processes till date but very few are commercially affordable and sustainable. Currently, this technology is being used in industries to produce scientific equipment, small structures and models for various applications.

Recently, NSWC Carderock made a fabricated model of the hospital ship USNS Comfort (T-AH 20) using its 3-D printer, first uploading CAD drawings of ship model in it. Further developments in this process can lead the industry to use this technique to build complex geometries of ship like bulbous bow easily. The prospect of using 3-D printers to seek quick replacement of ship's part for repairing purpose is also being investigated. The Economist claims use this technology to be the "Third Industrial Revolution".

2) **Shipbuilding Robotics** : Recent trends suggest that the shipbuilding industry is recognizing robotics as a driver of efficiency along with a method to prevent workers from doing dangerous tasks such as welding. The shortage of skilled labour is also one of the reasons to look upon robotics. Robots can carry out welding, blasting, painting, heavy lifting and other tasks in shipyards.

Geoje shipyard in South Korea which boasts of launching around 30 ships a year, 68% of its production processes is carried out by robotic systems which contributed to achieve it such a high production rate.

Robot was first designed for welding process in shipyards but now inspection and pipe cleaning robots have also come. The most interesting one is spider robot which autonomously crawls over the surface of vessel and prepares surface for painting by blasting off rust and other contaminants. The 'Iron Man' wearable robot is also in fray which can enhance worker's strength and stamina. Hyundai Heavy Industries (HHI), which has developed mini welding robots, is set to use robotics in shipbuilding. These trends clearly suggest that the future of shipyards will be smart and digital.

3) Ballast Free Ship Design : The concept has potential to mitigate the problem of ballast water disposal which causes discharge of non-native species and creates several ecological problems.

he design has network of longitudinal pipes from bow to stern in ship's hull causing constant flow of local sea water which prevents transfer of contaminated water or water of one ecosystem to other.

Though this technology is in experimental and developmental stage, if it is successfully tested, then ballast free design is definitely going to be the future of shipbuilding.

4) LNG Fueled engines : Liquefied Natural Gas (LNG) surge in popularity as an alternate fuel for ships is visible these days because of its environmental friendliness. That is why, the market of LNG fueled ship engines is emerging and its prospects are high as well.

In the LNG engines, CO2 emission is reduced by 20-25% as compared to diesel engines, NOX emissions are cut by almost 92%, while SOX and particulates emissions are almost completely eliminated. Moreover, the new generation ship engines are strongly required in order to comply with the TIER 3 restrictions of 2016 by IMO.Therefore, LNG solution is the best at the moment and the industry realizes it as well.

The major ship engine designers, Mitsubishi, Wartsila, Rolles-Royce and MAN Diesel & Turbo, are busy in the technological development of LNG fuelled engines. Classification societies are also active in this regard and have issued "Rules for LNG for Ships". Recently, Deen shipping developed a 6,100 dwt dual-fuelled chemical tanker named 'MTS ARGONON' which is the world's first new-built LNG fueled tanker. Classed by Lloyd's Register, it sails on dual fuel, 80% LNG & 20% diesel.

Besides being an environmental friendly fuel, LNG is also cheaper than diesel, which helps the ship to save significant amount of money over time. Furthermore, LNG powered escort tug has been developed by BB with LNG engine support of Rolles-Royce marine. If these indications are anything to believe, most of the future ships will be LNG powered contributing in green shipping

5) Solar & Wind Powered Ships : Imagine the situation when we will have finished all our reservoir of oil and gas; really horrible! Sailing ships, once used in past, are definitely not going to return but shipbuilding industry is trying hard to develop technologies to utilise renewable sources of energy (i.e, wind & sun) to run the ships considering today's challenges.

The world's largest solar powered ship named 'Turanor' is a 100 metric ton catamaran which motored around the world without using any fuel and is currently being used as a research vessel. Though exclusive solar or wind powered ships look commercially and practically not viable today, they can't be ruled out of future use with more technical advancements.

Recently, many technologies have come which support the big ships to reduce fuel consumption by utilizing solar panels or rigid sails. A device named Energy Sail (patent pending) has been developed by Eco Marine Power will help the ships to extract power from wind and sun so as to reduce fuel costs and emission of greenhouse gases. It is exclusively designed for shipping and can be fitted to wide variety of vessels from oil carrier to patrol ships.

6) <u>Buckypaper</u> : Buckypaper is a thin sheet made up of carbon nanotubes (CNT). Each CNT is 50,000 thinner than human air. Comparing with the conventional shipbuilding material (i.e. steel), buckypaper is 1/10th the weight of steel but potentially 500 times stronger in strength and 2 times harder than diamond when its sheets are compiled to form a composite. The vessel built from this lighter material would require less fuel, hence increasing energy efficiency. It is corrosion resistant and flame retardant which could prevent fire on ships. A research has already been initiated for the use of buckypaper as a construction material of a future aeroplane. So, a similar trend can't be ruled out in case of shipbuilding.

7) **Integrated Electric Propulsion** : The integrated electric propulsion technology is an arrangement wherein gas turbines or diesel generators or both generate three-phase electricity which can be used to power electric motors which turns propellers or water jets. The system uses electric transmission instead of mechanical transmission which eliminates the need for clutches and reduces or eliminates the use of gearboxes. Some of the advantages of using this technology are freedom of placement of engine, less noisy ships, reduction in weight and volume etc. Warships of future like HMS Queen Elizabeth of Royal Navy and Zumwalt Class Destroyers of US Navy will use the integrated electric propulsion.

CHAPTER 6 : PLACING THE SHIPBUILDING INDUSTRY IN AN ECONOMIC CONTEXT

In trying to understand the extent and impacts of structural changes in the industry, it would be helpful to place the shipbuilding industry in a broad economic context, in order to examine the relationship between government and the industry, and how global changes may affect those relationships.

In very general terms, the reason private companies enter the shipbuilding industry is to generate profits, or at least to diversify and/or broaden or deepen their industrial capability.However, governments are more likely to see shipbuilding as a strategic industry capable of delivering public policy outcomes.

While increasingly shipyards are turning to private ownership, in earlier times the industry was considered to be of such strategic and economic importance that yards in many countries were in public ownership.Because of the importance of the industry, the traditional shipbuilding nations supported their shipbuilding industries with financial assistance,particularly after the late 1950s, in order to ensure that they could continue to carry out their traditional roles, despite changes taking place in international trade and commerce. For their part, new shipbuilding nations (starting with Japan) were providing substantial financial backing to establish shipbuilding as major new national industries, a process that still continues.

Even when industries are partially or fully privatised,governments rarely lose complete touch with the sector, because of the perceived ability of the industry to have significant economic impacts, and because of its ability to deliver public policy outcomes.This tendency by governments to interfere in the market is themain reason why the objective of bringing normal competitive conditions to the industry is still unfulfilled.

Different governments, in different economies at different stages of their economic development will perceive the shipbuilding sector in quite different ways, but conceptually these perceptions could include:

Employment generator.

Shipyards have always employed large numbers of persons, and that remains the case, even with the introduction of automation to improve productivity. In particular, governments of newly industrialising economies where heavy industries (such as shipbuilding and steel) are perceived as important first steps into the value-added industrial sectors, see shipyards as particularly effective employment generators.

In addition, shipyards require high order skills ranging from welding, fabrication and design to management and commercial activities, and these are also important contributors to national industrial capability. The training of workers provided by the yards is important to the yards to maintain its skill base, but also to governments for the increased employment opportunities that this creates both within and outside the shipyards themselves. In the mid-1970s, the decline in shipyard orders throughout the world led many shipbuilding economies to provide assistance to ensure the continuation of theirdomestic industries when these were under pressure from more efficient competitors. In some cases this extended to the nationalisation of the industry, in order to avoid politically unacceptable large-scale unemployment.

New yards are generally located near areas where workers are plentiful, but also frequently are areas of high unemployment, which of course is helpful to governments by increasing work opportunities to reduce unemployment rates. Commensurately, governments are understandably concerned when shipyards reduce their operations or close down, as this inevitably results in large numbers of workers entering the labour market. A frequent response by government is to offer some kind of assistance as a lifeline to yards to at least partially continue their operations. An example of this was the restructuring of the shipbuilding industry in the 1980s in Europe and Japan which led to significant job losses.As a more recent example, the call for the speedy privatis ation of yards in Gdynia and Gdansk (Poland) by the European Commission were fiercely contested by the Polish Government, unions and even members of the European Parliament because of the severe job losses that this would entail

Economic kick-starter in depressed regions

When faced with depressed regions the first action by governments is to seek ways of generating employment, so that the "trickle-down" effects can spread benefits throughout the local economy. As noted earlier, shipyards are effective generators of both skilled and unskilled employment. This makes them very attractive to governments, which in turn creates a natural desire for governments to attract and keep shipbuilding activities in those depressed regions, often by offering substantial enticements, ranging from direct subsidies, to tax breaks, regional development aid and other preferential treatment.

A secondary, but related reason why shipyards are valuable to depressed regions is that they build a pool of skilled labour in the area, which in turn acts as a magnet for further investment, including foreign investment, keen to tap into the skill base, production facilities and lowers costs associated with the region.

Contributor to industrial capacity.

Most economies, and particularly those that are rapidly developing, consider industrial capacity as a cornerstone of their economic development. In this context, "industrial capacity" is defined as the ability of the national industrial sector to sustain manufacturing of a wide ranging group of intermediate and end products; for example, steel production, car manufacturing and shipbuilding. These industrial capabilities, as well as contributing to GDP are also considered by governments as insulating them to some degree from interruptions –due to wars, social/economic upheavals and acts of God –to external sources of capital and consumer goods. For developing economies foreign exchange earned through shipbuilding can also act as a stimulant to industrial capacity through the expansion of facilities to meet export demand.

While the notion of self-sufficiency has rapidly declined in the wake of growing globalisation, there are still strong residual beliefs that some in-house capacity and skills are necessary for military as well as commercial needs –just in case.
Shipbuilding falls into this category, hence its frequent status as a strategic industry, especially in developing economies.

Strengthen technical and technological capability

Although shipbuilding is often regarded as an "old" industry, the design and construction of vessels still requires considerable technical and technological capability, and as such is greatly prized (especially in developing countries) for the downstream benefits that come from access to such technology. For example, employees gains skills that can be readily transferred to other activities, and the technology used in shipbuilding encourages associated support industries.

One of the objectives of governments when opening of up inward investments by foreign enterprises has been to acquire technological capability, with technology transfers frequently being part of the conditions associated with cooperative or joint ventures with local shipbuilders.

Governments generally consider the development and maintenance of manufacturing enterprises such as shipbuilding as crucial to maintain a reservoir of technical and technological capability, and will frequently resist plans to close down such enterprises. In the past, the desireof governments to keep such facilities open and operating has been one of the reasons for the granting of government support that has acted to distort the shipbuilding market.

Defence Capability

This was already alluded to in the last paragraph, but is important enough to be listed separately. Every country/territory with a coastline considers some kind of naval military capability as an absolute necessity. Wherever possible these naval craft should be produced domestically, generally through joint ventures and associated technology transfers.

While military naval production and commercial shipbuilding are generally treaded as quite separate activities the fact remains that production facilities are too some degree interchangeable, and yards can switch relatively easily from one type to the other.An example of this can be found in theconversion of military yardsto commercial production that was common following the political changes in Russia and eastern/central Europe in the 1990s.

Therefore, commercial facilities (and their skilled workforces) can be considered by Governments as potential naval vessel producers if the need ever arises, which would add to the weight of argument for their retention even when they are not commercially viable.

Investment Vehicle

Governments generally strive to make domestic conditions attractive to forei gn direct investment (FDI) which can stimulate the economy, create employment and enhance industrial capacity. The construction of new construction facilities, or the upgrading/refurbishment/expansion of existing facilities would require considerable capital injections into the local economy, and governments may provide tax, land/infrastructure or other incentives in order to attract those investments.

However, governments can differ significantly with respect to the level of ownership and control permitted with respect to those capital investments. Some governments will allow only highly regulated investments in joint ventures with local partners and with majority control held by domestic interests. Technology transfer requirements may also be part of the conditions of those capital investments.

At the other end of the scale, some governments will permit 100% foreign ownership and control, while there are, of course, many different combinations and permutations in between.

Public Sector Policy Delivery

For most governments, major national institutions can act as vehicles for the delivery of public policy objectives. Obvious examples of this are postal services in most countries, which, in the national interest of equality are compelled by governments to offer comparable postal services and charges that are the same whether they travel around the corner or to a remote corner of the country. Even when partially or totally taken out of public ownership such enterprises can find themselves with "public service" obligations, intended to meet one or more public policy objectives. Basic telephone service providers have often found themselves in such a situation even as they moved from public to private ownership.

For enterprises or service providers that are wholly or substantially publicly owned, it is easy for governments to direct them to meet those public service objectives. For privatised enterprises such obligations can be imposed in a variety of ways, such as imbedding those obligations in licences (such as telecommunications or broadcasting) or through the government retaining some controlling influence on the activity of the enterprise (golden shares or shares with enhanced voting rights).

For purely private enterprises the task is more difficult for governments, and the achievement of public sector policy objectives generally requires a "carrot or stick" approach. For example, access to some forms of government support (such as subsidies, R&D support, tax concessions and so on) may be linked to the enterprise meeting some public policy objective, such as employment generation, or establishing facilities in a depressed region.

Profit/tax potential

While profitability is of paramount interest to private sector enterprises this is not always a priority for public sector operations, which may have alternative objectives that are of crucial interest to governments (which have already been briefly outlined).

However, one desirable side effect from profitable enterprises is that they generate tax revenues from those profits (as well as any associated industries that the shipyards might sustain) and tax revenues from the earnings of employees. Conceptually, one would expect that if a shipyard is attractive to governments forone or more of the reasons that have been examined in this section, then a shipyard that is profitable and pays income tax would be doubly attractive.

CONCLUSION

As mentioned before shipyards, from the beggining of their existance are definitely a big part of the worldwide economy. Shipbuilding is taking advantage of highly advanced technologies which aim to increase and hasten the productivity of new built ships and their maintanance while solving the issues such as environmental pollution, rising fuel etc. Shipyards are also generating employment even with the introduction of automation. This makes them very attractive to governments which strive to make conditions attractive to investments which can stimulate the economy, create employment and enhance industrial capacity.

BIBLIOGRAPHY

- **http://www.oecd.org**
- **http://en.wikipedia.org**
- **http://trusglobal.com**
- **http://www.ship-technology.com**
- **http://www.nap.edu**