ANALYSIS OF DELIVERY ALACRITY OF MERCHANT SHIPPING VESSELS BY INDIAN SHIP BUILDING COMPANIES

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Abstract

The development of the shipbuilding sector has the potential to positively impact the economy including service sectors. To realize its growth potential, the sector needs to establish and achieve a critical mass. The window of opportunity presented by the ongoing boom phase needs to be capitalized to firmly ground the industry along with its ancillaries. Indian shipbuilding has substantial plans for investment of around INR 200 bn. over the next 5-10 years, in capacity expansion and up gradation of the existing yards. However, this investment and consequent benefits can materialize only if supportive measures are continued by the Government to address the systemic disadvantages affecting the competitiveness of Indian shipbuilding industry. In addition, proactive action by shipyards to promote ancillary buildup is critical. Addressing these disadvantages are likely to not only make the commercial shipbuilding industry competitive, but also create strategically beneficial options for meeting India's defense requirements. The research study pertains to the delivery alacrity of merchant shipping vessels of Indian ship building companies.

Keywords: Critical mass, Alacrity

Introduction

Shipbuilding is known as one of the oldest, most open and highly competitive industry in the world. Shipbuilding is truly a global industry. It is also technological intensive, labor intensive and capital intensive industry. So, for the development and expansion of this industry, numerous parameters are to be considered. Because ultimate goal is to become competitive relative to other neighboring countries considering of all the related parameters. As a labor intensive industry, labor input, labor availability, labor cost, labor hour etc. are very crucial to assess the present status and future development of shipbuilding industry. Although cheap labor is big advantage, however international competitiveness and market shares shall not depend on cheaper labour alone as lower productivity and efficiency may nullify this advantage. As a technology-driven sector, constant improvement of engineering skills and adaptation of new technologies will keep one ahead of others in the competition. Furthermore, the requirement of raw materials, components as well as appliances for ships by the industry also play important roles for the sustainability of this sector. On the other hand, the development of the industry needs large investment on facilities and infrastructure, which will definitely benefit other sectors. Political support is one of main influencing factors in shipbuilding which is certainly an international business. The downfall of the British and Swedish ship-building

industries and the successes of Japanese and Korean shipbuilding were the direct outcome of lose or gain political support.

A Brief Overview of Ship Building Industry

When vessels were built of wood, the easy availability of this material made the United States the first major player in shipbuilding in the early part of the 19thcentury. However, as wood was replaced by iron and steel in the 1850's, Britain took over the leadership, and it remained the leading shipbuilder until 1956, when it lost its leading position after being overtaken by Japan. During the recession of the 1980s, all shipbuilding regions worldwide experienced significant fall in orders, a trend that was exacter-bated by the subsequent oil crises. About half of the shipyards worldwide disappeared from the map during this period, and employment in the industry was effectively halved. Until the middle of the last century, European shipbuilding dominated the world. Fast growth of the Japanese economy and successful coordination of supporting program for shipbuilding as a strategic industry helped to win leadership for this country. For some time, Japan and Europe controlled 90% of the market, but gradually dominance was overtaken by Japan. In 1970s, South Korea following previous experience of its neighbouring country, announced shipbuilding as strategic industry and in combination with low labour costs, began to reach the leadership. Next Asian player- China, caught the industrial expansion strategy and surpassed Japan in 2006 and South Korea in 2009 (if measured by order book volumes). New shipbuilding entrants such as Vietnam, India, Turkey, the Philippines, Brazil, and Russia grew up and together reached the quantity of orders to equal European total. Europe has gradually been losing its positions in shipbuilding despite of its strategic specialization as a niche player. Unfair competition on the part of Asian shipyards and delayed agreements in global playing field have distorted the market, shifted it to the Far East and created extra problems fighting against crisis. In September 2008, the new building boom that ran since 2003 ended sharply. The crisis didn't have pity neither for leaders nor for ordinary players. Even at the end of 2010, despite the signals of economic recovery, order book for new building was decreasing continuously. By the end of September 2010, new global building portfolio was 26% smaller in comparison to the quantities of the same period in 2008. Good news is that the total number of contracts in 2010 was higher by 205% than in 2009. Shipyards should begin thinking about new orders by investigating new patterns for successful competition.

The shipbuilding and repair industry is a capital-intensive business requiring extensive initial capital to enter the industry and meet subsequent outfitting and technological requirements. These factors provide substantial barriers to entry, especially because the industry is not very profitable. The conference system was created to help protect this act. Through agreements enforced among the member groups, the conference system stabilized freight rates and the

production of new commercial vessels. The stability of this system is necessary for individual shipbuilders to establish a cost structure and pricing policy.

Requirements in a shipyard

The basic production facilities of the industry are the shipbuilding positions, either ship-ways or docks, along with work areas, essential supporting shops, and engineering and design capability. Heavy-duty equipment is used for bending, rolling, forming, cutting, and welding plates and shapes; for forming pipe and sheet metal; and for performing a wide range of machining operations. In addition, shipyards require storage facilities of open areas for steel, piping, sub-assemblies and other items requiring minimal protection as also shelters for machinery, equipment, stores, outfits, and other items requiring protection from rain, sun, or pilferage. Facilities for the assembly of heavy steel include large cranes and handling and conveying equipment. The shipyard also must have piers where the ships can be outfitted after launching. These piers are equipped completely with service facilities such as fire mains, electrical power supply, compressed air, and fresh water.

Dynamics of Shipbuilding Industry

Market Condition

As with any commercial enterprise, the shipbuilder has the problem of maintaining an adequate order book, obtaining necessary financing, obtaining and retaining competent personnel, establishing and maintaining suitable facilities, obtaining and utilizing the proper materials, and maintaining an organization that will use these resources properly and efficiently.

Assembly Line

The beneficial effects and the efficiency of the enterprise are materially enhanced if the orders are repetitive, to permit series production. The need for an assured market is implicit in all considerations.

Trained Manpower

The matter of obtaining and retaining competent personnel also has been a difficult problem for most shipyards. This problem is chiefly due to the cyclic nature of the order books and the workflow. Compounding the problem is the availability of work in the construction industry at higher levels of pay. A workload with a reasonable promise of continuing stability is the most significant factor in the attraction and retention of competent personnel.

Construction Material

The cost and availability of material is always important to a shipbuilder, since material constitutes about half the cost of the usual commercial vessel. The small demand for material and equipment from the shipbuilding industry leaves the shipbuilder with little bargaining power to improve prices and delivery.

Free Market

Unless they are bullied or bribed into building in domestic yards, ship owners will build ships wherever they can get the best bargains. The cheapest yards competent to build a particular ship type get booked up first, and owners coming into the new building market have to either wait in line, pay a premium for a ship originally ordered by someone else (new building resale), or move on.

Requirements for Success

Full fledged engineering skill and flexibility

Since favoured ship types of the market changes frequently every year, strong engineering capabilityl is the only way to maximize profit opportunity by changing product mix regardless of market changes. Hence presence of designers and engineers in the yard is essential.

Manufacturing Systems

Sophisticated and fairly structured manufacturing systems built by designers and managements, with every member of the yard contributing their long experience and consistent efforts to improve efficiency.

Reliance on Cheap Labour

Rely on gaining efficiency and improving engineering skills rather than purely on cheap labour.

Strong relationship with customers

Establish relations with most top tier shipping companies and ship owners. These relations can be secured through reliable delivery schedule and proven qualities. Top tier shipping companies and ship owners have shown stronger consistency of ship orders than speculative players.

Localisation

Localize most ship parts while importing some components to meet the request of ship owners. This enables yards to source every ship part cheaply and in time. To make one ship, 100,000 to 300,000 components are required. Perfect supply chain management is required to have seamless manufacturing system and operational efficiency.

Design Capability

Need to develop marine technologies, including next generation ships.

Finances

Need to improve industry fundamentals for sustainable growth.

Present Ship Building Market

The world shipping industries are venturing into areas of large vessels like Very Large Crude Carriers (VLCC) and specialised vessels such as super container liners, Pure Car and Truck Carriers (PCTC), advanced bulkers, tankers and Gas Carriers. The existing shipyards in Public and Private Sector do not have sophisticated facilities for construction or repair of such vessels. The facilities available in India, particularly the largest state owned shipyards are inadequate to undertake construction of large vessels. Therefore Indian shipping companies are placing orders for large vessels on foreign shipyards. Indian share in world new shipbuilding tonnage is less than 2%. The annual average global order book grew by 78.86 million DWT in the period 2001-05 and in excess of 100 million DWT in the last 2 years.

Table 1.1: World's Shipbuilding Activities(31st December 2014)

	2010	2011	2012	2013	2014
orderbook	1,28,013	1,11,442	92,300	1,02,900	1,07,673
neworders	38,581	30,823	24,713	53,839	14,565
completions	51,573	51,126	47,967	38,068	9,750

Figure 1.1: World Orders for Last 5 years

Statement of the Problem

In this paper, we are going to discuss the problems and issues in the Indian Shipyards that affects the delivery of the Vessels.

Literature Review

The top three competitors in ship building industry being South Korea, China, Japan. Apart from these competitors, there are several other European countries and America which is doing ship building as a business. Lets look at the facilities of the shipyards in these countries and compare them with the facilities available in India.

European Shipbuilding Industry

With the development of the carrack, the west moved into a new era of building the first regular ocean going vessels. These were of unprecedented size, complexity and cost. Shipyards became large industrial complexes and the ships built were financed by consortia of investors. There was very gradual development in the field of design till the early nineteenth century.

Other than its widespread use in fastenings, Iron was gradually adopted in ship construction, initially in discrete areas in a wooden hull needing greater strength, (e.g. as deck knees, hanging knees, knee riders and the like). Then, in the form of plates riveted together and made watertight, it was used to form the hull itself.

Initially there was traditional wooden construction with a frame over which the hull was fastened. Isambard Kingdom Brunel's Great Britain of 1843 was the first radical new design, being built entirely of wrought iron. Despite her success, and the great savings in cost and space provided by the iron hull, compared to a copper sheathed counterpart, there remained problems with fouling due to the adherence of weeds and barnacles. Later Great Britain's iron hull was sheathed in wood to enable it to carry a copper-based sheathing. As a result composite

construction with wooden timbers laid over an iron frame remained the dominant approach where fast ships were required.

Brunel's Great Eastern represented the next great development in shipbuilding. Built in association with John Scott Russell, it used longitudinal stringers for strength, inner and outer hulls, and bulkheads to form multiple watertight compartments. Steel also supplanted wrought iron when it became readily available in the latter half of the 19thcentury, providing great savings when compared with iron in cost and weight. Wood continued to be favoured for the decks, and is still the rule as deck covering for modern cruise ships.

Chatham Dockyard (England)

Chatham Dockyard, located on the River Medway and of which two-thirds is in Gillingham and one third in Chatham, Kent, England, came into existence at the time when, following the Reformation, relations with the Catholic countries of Europe had worsened, leading to a requirement for additional defences. For 414 years Chatham Royal Dockyard provided over 500 ships for the Royal Navy, and was at the forefront of ship-building, industrial and architectural technology. At its height, it employed over 10,000 skilled artisans and covered 400 acres (1.6 km^2). Chatham dockyard closed in 1984, and 84 acres (340,000 m^2) of the Georgian dockyard is now managed as a visitor attraction by the Chatham Historic Dockyard Trust.

The Treasurer of the Navy's accounts of the King's Exchequer for the year 1544 identifies Deptford as the Dockyard that carried out all the major repairs to the King's Ships that year. That was soon to change, although Deptford remained a dockyard for over three centuries. In 1547 Jillingham (Gillingham) water, as Chatham Dockyard was then known, is mentioned as second only in importance to Deptford; followed by Woolwich, Portsmouth and Harwich. In 1550 ships that were then lying off Portsmouth were ordered to be harboured in Jillingham Water, "by reason of its superior strategic location". Chatham was established as a royal dockyard by Elizabeth I in 1567. She herself visited the yard in 1573.

BAE Systems Maritime (England)

BAE Systems Maritime - Submarines, known as BAE Systems Submarine Solutions until January 2012, is a wholly owned subsidiary of BAE Systems, based in Barrow-in-Furness, Cumbria, England, and is responsible for the development and production of submarines.

It operates one of the few shipyards in the world capable of designing and building nuclear submarines, which has constructed all but three of the Royal Navy's nuclear-powered submarines since the commissioning of HMS Dreadnought in 1963. The ex-captions were HMS Conqueror, HMS Renown and HMS Revenge, which were built by Cammell Laird. The Barrow-in-

Furness shipyard has also been building submarines since the AbdÃijl Hamid was launched for the Ottoman Navy in 1886 and the Holland-class submarine for the Royal Navy was launched in 1901.

The shipyard was formerly operated by Vickers Shipbuilding and Engineering (VSEL). Upon the creation of BAE Systems in 1999, the submarine division became part of BAE Systems Marine.

As part of BAE Systems Marine, the yard constructed surface ships, such as the Albion-class landing platform docks. In 2003 however the company was split into BAE Systems Submarines and BAE Systems Naval Ships, with Barrow ceasing surface ship construction.

Table 2.1: Europe's Shipbuilding Activities (31st December 2014)

Particulars	2010	2011	2012	2013	2014
order book	6495	5836	5058	5705	6230
new orders	2487	1830	1859	2515	716
completions	4020	2474	2232	1975	416

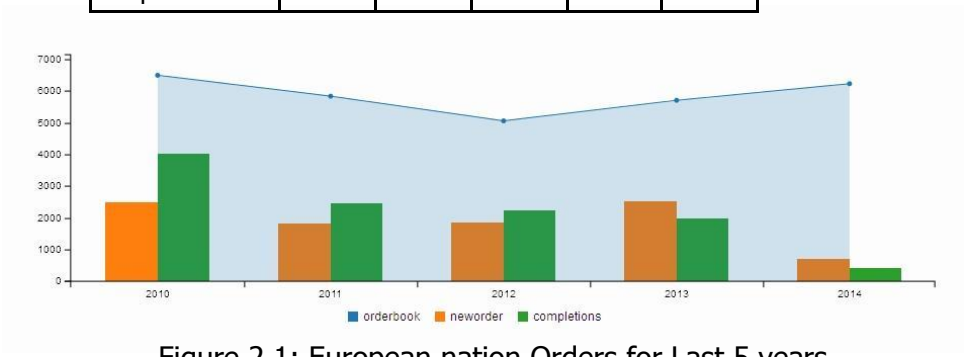

Figure 2.1: European nation Orders for Last 5 years

American Shipbuilding Industry

The United States has four shipbuilding regions, the Atlantic Coast, the Gulf Coast, the Pacific Coast, and the Great Lakes

The American Civil War began the decline of the U.S. foreign-trade merchant fleet. As vessels were lost as prizes, U.S. vessels shifted to foreign registry to lessen the risk of capture and to avoid exorbitant insurance rates. Vessels transferred this way were not permitted to return to the U.S. registry.

Even more far-reaching in its effects than the war itself was the development of steel-hull, steam-propelled ships. The advanced technology in England and other Eu-ropean countries gave foreign builders a considerable advantage in the cost of building iron vessels. Because it

was prohibited by law to register foreign-built ships under U.S. documentation, the high cost of domestically built ships demanded a heavier capital investment for U.S.-flag ships than for ships built abroad. The capital costs reduced potential earnings in foreign trade to a point where investment in U.S. transoceanic shipping was unattractive. Under these conditions, private capital was not attracted to the highly competitive field of shipping. The U.S. merchant marine declined from its once prominent position to a level in 1914 where only 9 percent of the value of foreign commerce, imports and exports, was carried in American vessels.

The outbreak of World War I in Europe in 1914 finally aroused the country to cor-rect this imbalance in its merchant fleet as U.S. ports were glutted with cargo for export with nowhere to go. The goal of the United States was to establish a merchant ma-rine fleet that could meet all of the country's commerce and military needs. Congress ultimately wanted this fleet to be owned and operated privately by U.S. citizens and enacted provisions such as tax savings and subsidy assistance to stimulate the transfer of the government-owned fleet to private firms. It also provided for the payment of subsidies to cover differentials in construction costs of foreign and domestic builders of vessels ordered for private operators for use on these routes. The post-war period began the decline of the U.S. shipbuilding industry. The down-turn was interrupted by four spurts of orders. The first program began in the late 1940s and carried into 1950. Wide fluctuation in demand over the post-war period, coupled with ambitious spending plans by U.S. shipyards to increase automation and with an increasingly competitive environment, resulted in the decline of the U.S. shipbuilding industry

Boston Navy Yard

The Boston Navy Yard, originally called the Charlestown Navy Yard and later Boston Naval Shipyard, was one of the oldest shipbuilding facilities in the United States Navy. Established in 1801, it was officially closed as an active naval installation on July 1, 1974, and the 30-acre (120,000 m^2) property was transferred to the National Park Ser-vice to be part of Boston National Historical Park. Enough of the yard remains in operation to support the USS Constitution. The USS Cassin Young, a World War II-era destroyer serving as a museum ship, is also berthed here. Among people in the area and the National Park Service, it is still known as the Charlestown Navy Yard.

Table 2.2: America's Shipbuilding Activities(31st December 2014)

Particulars	2010	2011	2012	2013	2014
Order book	72	103	123	145	124
New orders	45	36	35	72	27
completions	76	59	64	70	85

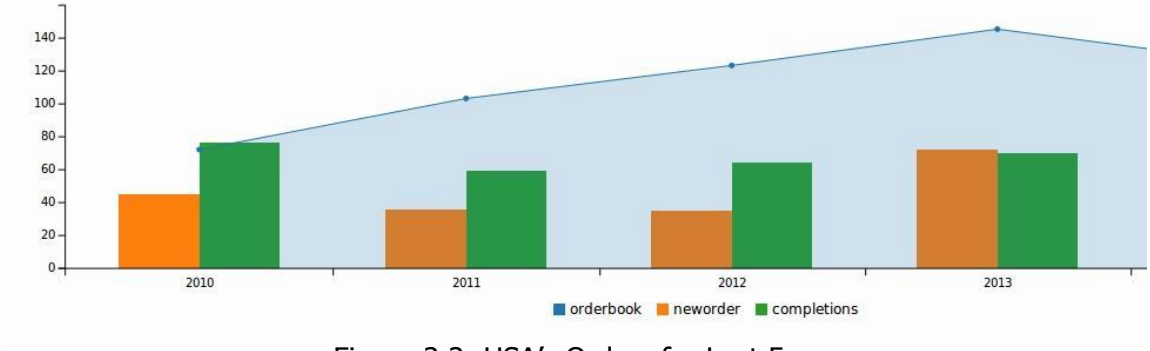

Figure 2.2: USA's Orders for Last 5 years

Japan Shipbuilding Industry

Japan used shipbuilding in the 1950s and 1960s to rebuild its industrial structure. As early as the early 1950s, the Japanese government launched a "Program Shipbuilding Scheme", which allowed the Japanese shipping companies to obtain favorable loans for fleet expansions. The scheme ruled the shipping companies who received the loads out of public money should only build the ships in Japan. Nowadays, the said scheme is still alive. Although some condition for applying governmental loads have been changed, the function of the scheme, which is to support domestic shipbuilders, still exist. Moreover, in order to attract orders of new buildings on the international market for the Japanese shipbuilders, the government provides low-interest loans to foreign ship owning companies through Export and Import Bank of Japan.

Table 2.3: Japan's Shipbuilding Activities (31st December 2014)

	2010	2011	2012	2013	2014
orderbook	19,836	16,132	12,534	13,615	15,266
neworders	5374	4118	4396	7550	3018
completions	9821	9162	8415	7092	2135

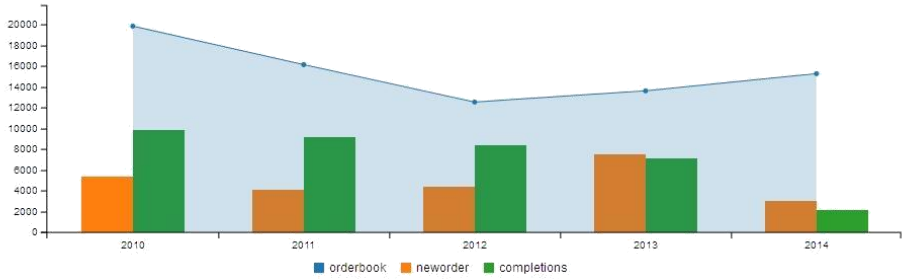

Figure 2.3: Japan Orders for Last 5 years

South Korean Shipbuilding Industry

In 1967, the enactment of Shipbuilding Industry Promotion Act paved the way for the shipbuilding industry. Since then, the industry has received tremendous support from the government. In terms of financial aids, the measures taken by the Korean govern-ment are quite similar to the Japanese government. In 1957, Export and Import Bank of Korea was set up to facilitate the Shipbuilding Industry. Currently, the portfolio size of the Bank is $ 900 million, which is one of the largest sources for ship financing in the world

South Korea started to make shipbuilding a strategic industry in the 1970s. South Korea is the world's largest shipbuilding nation with a global market share of 53.2% in 2011. South Korea is the global leader in the production of advanced high-tech vessels such as cruise liners, super tankers, LNG carriers, drill ships, and large-sized container ships. Her 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. Her "big three" shipbuilders, Hyundai Heavy Industries, Samsung Heavy Industries, and Daewoo Shipbuilding and Marine Engineering, dominate global shipbuilding, with STX Shipbuilding, Hyundai Samho Heavy Industries, Hanjin Heavy Industries, and Sungdong Shipbuilding and Marine Engineering also ranking among the top ten shipbuilders in the world.

In ship design, Korean yards are regarded as having 5 - 10 year advantage over Japanese peers, or even bigger gap at 10 - 15 years over Chinese peers. The key strength of Korean yards can be found from flexible product mix stemming from long building experience of every type of vessels. Based on market demand, they are able to penetrate every type of ship segment, and maximize their profitability. Also, this enables them to secure stable orders.
Table 2.4: South Korea's Shipbuilding Activities (31st December 2014)

	2010	2011	2012	2013	2014
orderbook	39,145	35,529	28,517	31,169	32,964
neworders	11,915	13,615	7,111	17,437	4,241
completions	14,906	15,954	13,393	12,027	2,793

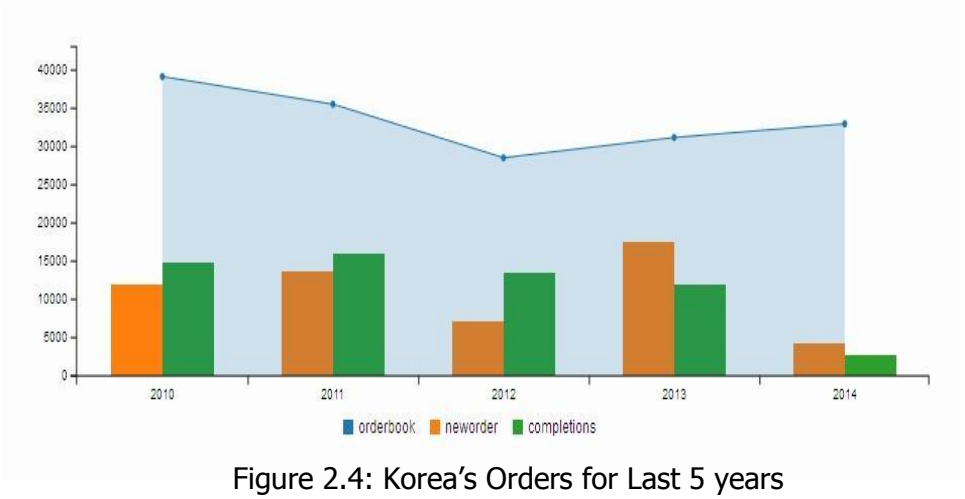

Figure 2.4: Korea's Orders for Last 5 years

Chinese Shipbuilding Industry

From the Chinese perspective, the supply of raw materials for domestic manufactur-ing, meeting the food needs of its populations and the transport of exports should to the extent possible be undertaken by Chinese built ships. Substantial construction of shipbuilding capacity in China has primarily been aimed at enabling China to be self-sufficient in sea transport. China is now in the process of repeating these models with large state-supported investments in this industry. In China it is also a strategic industry, intended to upgrade its national defence capability, drive economic development and serve as a catalyst for the development of the iron and steel, electronic, and machinery manufacturing industries.

Table 2.5: China's Shipbuilding Activities (31st December 2014)

	2010	2011	2012	2013	2014
orderbook	48,923	40,878	32,209	36,649	40,146
neworders	16,102	8,339	8,555	21402	5,964
completions	18,801	19,734	19,701	13,377	3305

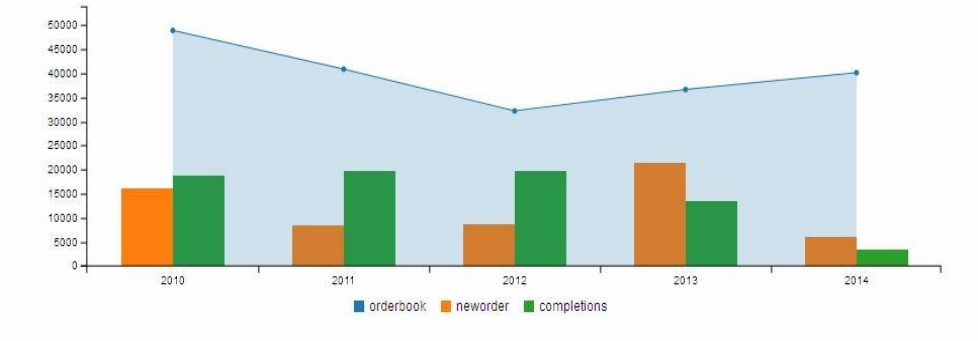

Figure 2.5: China's Orders for Last 5 years

Comparison by Order book

By considering data from table number 2.1,2.3,2.4,2.5, We compare the top four Com-petitors of the World's Shipbuilding.

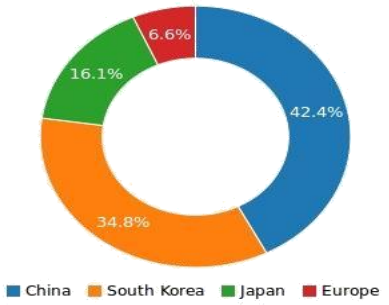

Figure 2.6: Comparision of 2014 data

Indian Shipbuilding Industry

India has a long history and tradition of shipbuilding that can be traced back to the Harappan civilisation. The Rig-Veda - one of the four Vedas - documents about the variously termed parts of a vessel in the oldest existing Indian language: the Sanskrit. Also, other detailing about the ancient marine industry is documented in the Arthashas-tra and various other writings of the ancient Indian folk-lore. The shipbuilding industry in India was mainly carried on in the coastal territories like Bombay, Cochin, Tuticorin, Mandvi and Cuddalore.

Table 2.6: Age of Vessels(As of 31 December 2014)

Item/Age	< 10	10 - 20	> 20	Total
No. of Vessels	455	270	479	1,204
GRT	4602	2793	2914	10,309

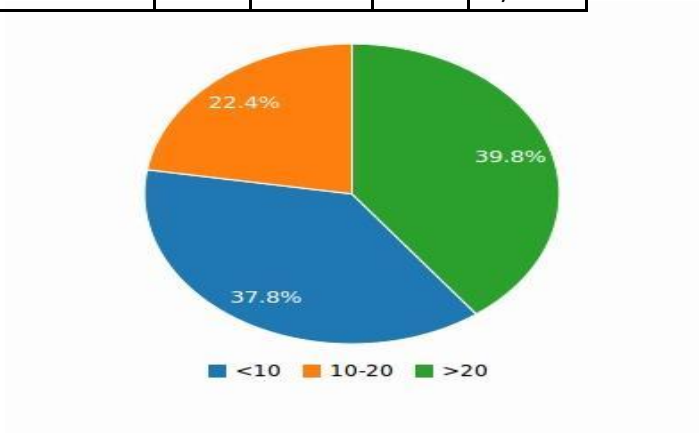

Figure 2.7: India's Vessels By Age

There are totally 338 companies in India. The first segment that is number of vessels below 10 years of age being 455 which is around 38% of the total number of vessels. The cohesion that comes into play due to such collaboration makes these companies all the more immune to certain eventualities. For instance, if a particular company were to lose a couple of ships temporarily due to wear-and-tear or some other reason, it would still have enough fleet strength to fall back on. However, the same cannot be said for the other unorganized shipping firms in the industry.

Research methodology

Research design

It is a detailed plan of action for the researcher which defines problem, identify data required and decide tool to be applied. It helps to make the research as efficient as possible.

Qualitative research refers to the meanings, definitions, characteristics, symbols, metaphors, and description of things. Qualitative research is much more subjective and uses very different methods of collecting information, mainly individual, in-depth interviews and focus groups.

Sampling design

Population

The population size of this study is

- European Shipbuilding Industry
- American Shipbuilding Industry
- Japan Shipbuilding Industry
- South Korean Shipbuilding Industry
- China Shipbuilding Industry
- Major Ports and Yards in India
- Ship Repair Industry
- Indian Shipbuilding Industry

Sample size

Sample is described as a portion chosen from the population. The sample size chosen for this study is ports in ship building industry.

Data collection field

1. Chatham Dockyard (England)
2. BAE Systems Maritime (England)
3. Ferguson Shipbuilders
4. Fincantieri Shipping Corporation

5. Boston Navy Yard
6. Brooklyn Navy Yard
7. Charleston Naval Shipyard
8. Oshima Corporation
9. Mitsubishi Heavy Industries
10. Kawasaki Shipbuilding Corporation
11. DSME
12. HHI
13. Dalian
14. Jiangnan

Recommendations and suggestions

Judge d by the present trends, recommendations for the future and suggestions for increasing the delivery alacrity of the vessels are as follows:

Research indicates that there is a positive and highly significant relationship between economic growth and manufacturing output growth (Tyler, 1980). History shows us that the evolution of nations as manufacturing powerhouses during various periods of time has a strong association with its shipbuilding output. The English during 19th century and early part of 20thcentury (Patrick et al, 1976), the Americans post world-war II (Zendong Lu, 2005), the Japanese during 1960-90 (Chida, 1990; Koenig, 2001), the Koreans post 1990 and recently the Chinese have emerged as major shipbuilding nations accounting for over 40% (sometimes more than 70%) of annual world ship production in terms of tonnage. It is interesting to note that the periods of rise of these countries as economic powerhouses and as major shipbuilding nations overlap. The shipbuilding industry, in addition to securing vital national security and economic interests, is critical to the development of other sectors such as steel, manufacturing, and other ancillary equipment and product industries. India being one among the fast growing BRIC nations is poised to be a major economic power by 2045. However, India's current shipbuilding output volume is abysmal to match our current economic growth.

India's CGT/GDP ratio is about 1/5 that of China whereas India's Export/GDP ratio is about 1/2 that of China. This represents a significant gap in domestic shipbuilding, in order to meet the international trade demands. There is a market out there which is untapped by Indian shipbuilders despite the unique advantages India has in shipbuilding and repair sector such long coastline, experience and expertise in ship construction, availability of cheap labor etc. The problems in our domestic shipbuilding will be touched upon in the subsequent sections of this paper. The consequence of these problems and deficiencies was explicit when India"s largest state owned shipping company placed its largest shipbuilding order of about $ 400 million for 6 aframax vessels with a leading East Asian shipyard.

Time and cost overruns, unfavorable fiscal policies and locked up capacity of domestic yards were reasons attributed to this overseas order position. The situation calls for serious thinking regarding many aspects such as government policies, planning, capacity addition, design, production technology, scheduling, supply chain management, improving productivity of domestic shipyards etc

Conclusion

The primary motivation of this paper is to study and analyze Indian shipbuilding industry, especially the management and operations practices, benchmark them with respect to global best practices, identify major problem areas and explore methods to improve the current situation. This article is based on field study of operations practices in various shipyards in India and East Asia. In order to establish world class bench marking in this field, Indian shipyards must be outfitted with cutting-edge facilities and the latest equipment, ranging from fully machine-driven steel-cutting lines to an eco-friendly painting shop. Other advanced facilities include a metal works factory, a forge, machine shops, a crankshaft shop and offline welding robots.

Modern shipbuilding makes considerable use of prefabricated sections. Entire multi-deck segments of the hull or superstructure will be built elsewhere in the yard, transported to the building dock or slipway, then lifted into place. This is known as "block construction". The most modern shipyards pre-install equipment, pipes, electrical cables, and any other components within the blocks, to minimize the effort needed to assemble or install components deep within the hull once it is welded together.

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