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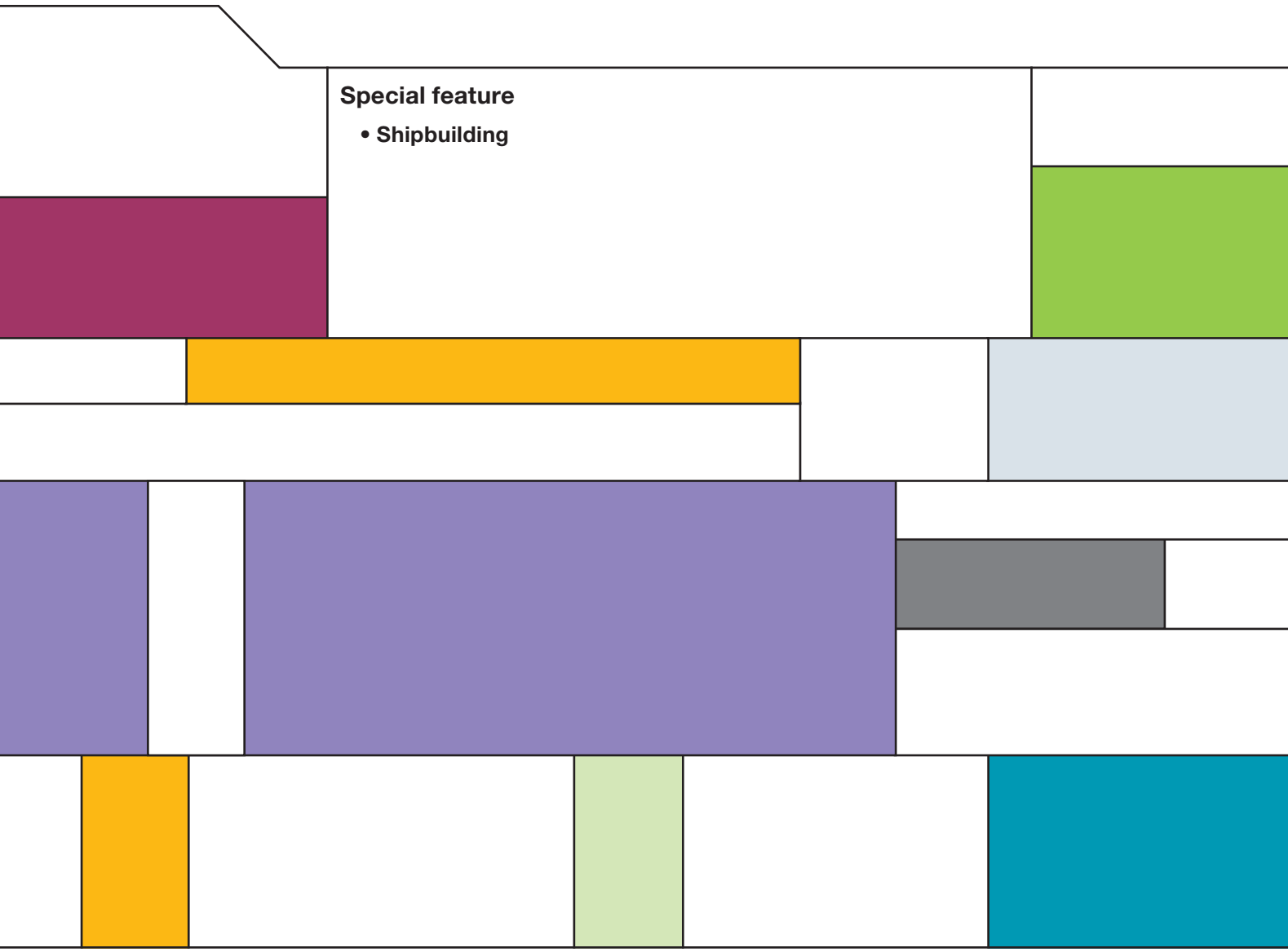

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Volume 2010/3

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Foreword

The mandate of the OECD's Council Working Party on Shipbuilding requires it to identify and progressively reduce factors that distort the shipbuilding market. In addressing that objective, the working party is also required to keep the shipbuilding industry under review and improve the understanding of the shipbuilding market.

These reports represent part of the work and analysis undertaken in order to better understand the shipbuilding market, especially in relation to structural issues and support provided by governments to their domestic industries that could bring distortions to the market.

The two country studies are specifically intended to provide a better understanding of specific shipbuilding sectors. While these reports deal with two non-OECD economies, the series of studies being undertaken for the working party will also cover the industries in OECD member countries.

The reports were prepared by researchers attached to the Working Party on Shipbuilding Secretariat.

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The interaction between the ship repair, ship conversion and shipbuilding industries

Özgur Umut Senturk*

Shipyards can undertake a variety of activities, not all related to the construction of new vessels. While there are yards that are largely dedicated to new buildings, and others dedicated to ship repair and maintenance, in practice that distinction is blurred, as both activities can be undertaken in most yards. This report examines the interaction between these yards, in particular how feasible it is for yards to move from one activity to the other, or perhaps to engage in both at the same time. The relevance of this is that if there are few barriers for yards to move between activities, then this will have an impact on the availability of shipbuilding capacity to meet expansions or contractions of new-building demand.

* This study was largely undertaken by Mr. Özgur Umut Senturk, who was seconded from the Government of Turkey to work on shipbuilding matters. This work is published on the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein are those of the author and do not necessarily reflect the official views of the Organisation or of the governments of its member countries. Special thanks are given to Turkey for its generous voluntary contribution, without which this project would not have been possible.

Introduction

Ship repair yards offer maintenance services to ship owners, so that the ships can be operated profitably and kept in proper condition, in line with the regulations of the International Maritime Organization (IMO), their flag states requirements and the minimum standards of classification societies.

Importantly, ship repair does not necessarily imply the need for a dock, as work (even complex underwater work) can often be undertaken alongside at berths. This, of course, greatly increases the flexibility with which ship repair service can be delivered, and minimises the need for extensive (and expensive) fixed installations.

On the other hand, ship conversion services alter the structure and/or configuration of vessels in order to enable them to carry out a different purpose than was originally intended when the vessel was built. The conversion of tankers to operate as bulk carriers is an example of such a conversion. These conversions are generally substantial in nature and require the availability of extensive facilities and labour skills that are often indistinguishable from those required for a new vessel.

Ship repair work is by nature labour intensive[1] and not prone to automation. This provides an immediate advantage to developing economies that have an abundant supply of low-cost labour. On the other hand, as already noted, ship conversion work has significant common characteristics with shipbuilding, including automation and outsourcing, and so this sector does not automatically share this natural advantage.

Traditional, big repair bases like Rotterdam, Hamburg, Singapore and several yards in Japan face increasingly strong competition in services ranging from "simple" activities, such as general repairs, to complex tasks, such as extensive refits or conversions. This competition comes from yards in Eastern Europe, China and Viet Nam, which are actively entering the market.

The ship repair market

Different yards for different needs

The technologies employed in ship repair have undergone major changes in recent years, resulting in a drastic reduction in docking and lay-up time for repairs. Many yards have invested in sophisticated equipment to ensure high safety and environmental standards when carrying out maintenance and repairs, such as the replacement of steel plates, the cleaning of tanks and so on. In addition, modern vessels are increasingly complex, with automated systems that require constant attention as well as regular maintenance and rectification, and this has also increased the need for greater sophistication and skills on the part of the service providers.

However, despite advances in technology (such as robotics, modular fabrication, advanced IT systems and procedures), ship repair remains a labour intensive business, as virtually every job will be unique in some respect (*e.g.* the amount, nature and location of steel replacement, so automation is not always an available solution.

This labour intensity means that facilities that have access to ample skilled, low-cost labour will have a cost advantage for less complex repair/maintenance work over their competitors in higher-cost centres, even if they cannot match them in terms of technology.

This means that the selection of the appropriate ship repair centre has become crucially important to shipowners, who frequently must decide between the choice of a financially attractive low-cost centre and the need for a certain degree of reliability and technical sophistication. Therefore, while some owners will be drawn to lower-cost yards in locations such as China (because of favourable steelwork replacement costs), others may choose yards elsewhere that might offer (albeit at higher cost) specialised vessel servicing and overhaul. For example, the Singapore-based Keppel repair yard has a strong reputation for servicing liquefied natural gas (LNG) and liquefied petroleum gas (LPG) carriers, while some European and US repair yards have established a significant niche in the cruise ship sector.

The availability of these alternatives gives shipowners significant opportunity to select the service of their choice, but significantly they may not always be able to effectively exercise that choice.

What drives demand for ship repair services?

The main demand for ship repair work stems from planned, scheduled routine maintenance for the vessels. These scheduled activities are necessary in order to ensure that vessels are seaworthy and in optimum operating condition to maximise their earning capacity. Scheduled calls at ship yards for routine repair/maintenance (which may require dry-docking) are also driven by the need for regular class inspections by classification societies (normally every five years). The important common characteristic of these scheduled activities is that they are planned, and therefore the ship owner or operator has considerable freedom to select the repair facility of his choice.

On the other hand, unscheduled repairs, whether through breakdowns or incidents, are clearly less predictable, and there may be little flexibility in the timing and choice of location to effect repairs. In these instances shipowners and operators may have no choice but to use local ship repair services, regardless of the cost or quality of those services.

Apart from breakdowns and incidents, unscheduled repairs are increasingly being dictated by PSC (Port State Control) authorities, which are targeting their inspections in order to maximise their chances of discovering defects. These targeted campaigns can be based on types of vessels, flags of registration and classifications societies, and frequently result in vessels with serious (and sometimes not so serious) defects being detained until those defects are rectified.

A further determinant of demand for unscheduled repairs is that arising from the conditions of sale of second ships, where transactions frequently require evidence of a recent dry-docking by the vessel. Consequently, the extent of the sale and purchase market can become a factor in the demand for dry dock use.

The re-activation of vessels that are laid up (when demand for vessels is low) is another element affecting inspection, maintenance and repair activities. While this has not been an issue for some time due to the very high level of world economic activity, from time to time it could be very significant as it was in the 1980s, and it remains a factor in assessing nominal demand for drydock use (Drewry, 2001).

Assessing future demand for ship repair services is difficult, not least because (as mentioned above) a considerable amount of this demand is unscheduled, and will depend on exogenous drivers. The one thing that can be said about future demand is that its growth will have some relationship with the growth of the world fleet, and based on current order books, will be significant in the short to medium term (*e.g.* to 2012).

The growth of the world fleet

During the course of 2007, the order book for the world merchant fleet grew to a record high level, four times bigger than what was recorded before the current cycle started in 2003 (see Table 1). Demand for new ships has exceeded delivery capacity, and shipyard order backlog has become increasingly longer, with shipowners placing orders now not expecting delivery until 2012 or beyond. This strong demand for new vessels will greatly increase the number of vessels in the world's commercial fleet, which will also (gradually and proportionately) increase the natural demand for ship repair and maintenance services.

Table 1. **Shipbuilding new orders in million cgt, 2000-2007**

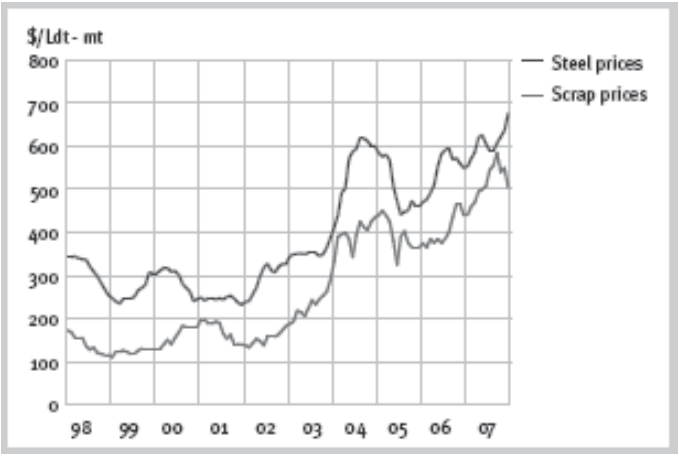
Year	2000	2001	2002	2003	2004	2005	2006	2007
CGT (mill.)	42.90	48.20	48.90	70.80	92.80	107.2	138.0	177.7

Source: Lloyd's Register-Fairplay (2007), *Register of Ships*, December.

Just as there are additions to the fleet, there are also deletions, as vessels become uneconomic or unseaworthy and are recycled (or scrapped in earlier terminology). However, because of the very strong demand for shipping service, and the delays in delivery of new vessels, since 2003 demolition levels have been particularly low, at around 10% of new orders, compared to 70% during the previous cycle (BRS, 2008). Therefore, even as the world fleet is being renewed, the number of old ships is not commensurately decreasing, particularly in the dry bulk sector where charter rates have been particularly strong, and where owners have chosen to pass surveys for their older vessels and continue trading.[2]

As a different measure, recycling was down from 7.2 million dwt in 2006 to 5.7 million dwt in 2007, which is the lowest scrapping activity seen since the early 1990s, an indication that until the global economy tightens (which may now be happening), or the value of scrap steel increases enough (see Figure 1) to make the continued operation of older vessels uneconomic, we can expect the size of the world's fleet (and therefore the demand for associated ship repair and maintenance services) to increase (Platou, 2008).

Figure 1. **Steel and scrap prices 1998-2007**



Source: Platou (2008) *The Platou Report 2008*, Annual Shipping and Shipbuilding Markets report.

The available evidence clearly points to the overall demand for ship repair and maintenance services increasing significantly in future years, as the maintenance cycles for the growing commercial fleet (including new-buildings) come into operation.

While little can be said about the total demand for ship repair and maintenance services, it has been reported by Worldyards Research[3] that the demand for dock space to carry out the five year statutory drydock cycles for big ships[4] (which require dry-docking) is expected to rise rapidly through to 2015, as shown in Figure 2. Based on the steeply increasing demand for such services (more than 100% between 2007 to 2015), it might be possible to speculate that there will be pressure on repair yard capacity, especially if some of that capacity has been converted to either conversion or new-building work, to take advantage of the very high demand and high prices for those services.

The ship conversion market

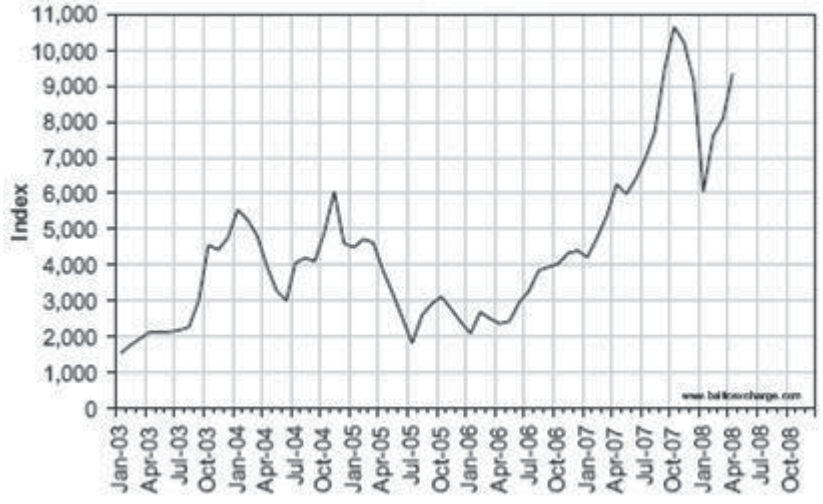
Conversions are becoming increasingly popular as ship owners try to overcome high new-build prices and long delivery times by adapting existing vessels for different roles, as the relatively short time required for a conversion is preferable in many cases to bulk carrier new-building lead times of up to four years. This has encouraged, for example, the conversion of single hull tankers (which are largely due to be forced out of service in 2010 by IMO regulations) to operate in the dry bulk trades, where there are fewer environmental concerns with their cargoes, and which are currently enjoying high freight rates (see Figure 3).

Figure 2. **Scheduled repair demand estimate, 2007-2015**

Segment	Anniversaries (multiple of 5s)	Year									
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Large Bulker	5th	34	23	33	44	54	65	57	39	107	161
	10th	50	46	12	30	33	34	23	33	44	54
	15th	19	23	31	29	39	50	46	12	30	33
	20th	31	22	9	15	38	19	23	31	29	39
	25th	28	30	9	17	20	31	22	9	15	38
	Total	*162*	*144*	*94*	*135*	*184*	*199*	*171*	*124*	*225*	*325*
Large Container	5th	57	43	38	47	58	101	72	97	88	107
	10th	20	21	17	14	35	57	43	38	47	58
	15th	0	0	0	0	8	20	21	17	14	35
	20th	0	0	5	0	0	0	0	0	0	8
	25th	0	0	0	0	0	0	0	5	0	0
	30th	0	0	0	0	0	0	0	0	0	0
	Total	*77*	*64*	*60*	*61*	*101*	*178*	*136*	*157*	*149*	*208*
Large Tanker	5th	58	95	139	109	120	98	117	125	239	155
	10th	46	39	68	95	85	58	95	139	109	120
	15th	64	82	77	49	46	46	39	68	95	85
	20th	31	26	29	42	40	63	82	77	49	46
	Total	*199*	*242*	*313*	*295*	*291*	*265*	*333*	*409*	*492*	*406*
LNG	5th	1	10	14	21	18	26	32	53	55	17
	10th	6	5	3	6	12	1	10	14	21	18
	15th	1	1	4	8	5	6	5	3	6	12
	20th	0	0	0	3	2	1	1	4	8	5
	25th	7	1	3	4	1	0	0	0	3	2
	30th	3	8	6	5	3	7	1	3	4	1
	35th	0	0	1	1	1	3	8	6	5	3
	Total	*18*	*25*	*31*	*48*	*42*	*44*	*57*	*83*	*102*	*58*
Grand Total		**456**	**475**	**498**	**539**	**618**	**686**	**697**	**773**	**968**	**997**
Annual Rate of Growth		-	4.17%	4.84%	8.23%	14.66%	11.00%	1.60%	10.90%	25.23%	3.00%
Accumulative Growth 2007-2015											109.89%

Source: Worldyards (2007), *Moving Up the Value Chain or Regression?*.

Figure 3. **Baltic Exchange Dry Index[1], 2003-2008**



1. The Baltic Dry Index is an index covering dry bulk shipping rates and managed by the Baltic Exchange in London.

Source: SSY (2008), *SSY Monthly Shipping Review*, SSY Consultancy and Research Ltd, London.

In practice, conversions differ significantly from routine ship repair and maintenance because of the complex, high value work that is associated with those conversions (with the commensurate need for higher order facilities and skills). In addition, the time required for the work to be carried out is generally greater, as conversion contracts might run for months, and in some cases for more than a year, rather than days or weeks. In these respects ship conversions have elements that are very similar to shipbuilding, and as such the sector could be considered as a bridge between the more routine ship repair/maintenance sector and the dedicated shipbuilding yards.

The demand for ship conversion services is driven by a variety of factors, none of them readily amenable to forecasting. In "normal" times, shipowners may elect to undertake a conversion in order to facilitate the entry of the vessels in a different market niche (for example, lengthening a tanker to increase its capacity). Such decisions are generally opportunistic, and impossible to predict. Generally, however, there would be few pressures to justify the expenditure of dry-docking such vessels over the alternative of simply letting them operate (as sunk costs) until they are totally uneconomic and are recycled.

However, this presumes that there is some normality in the shipping market, and that there are no exogenous pressures that make the effort of conversion worthwhile. In fact, over the years (and at present), there have been a number of relatively unique circumstances that have strengthened the demand for ship conversion services.

At present, the very rapid economic growth in recent years (principally generated by China) has placed extreme pressure on the world commercial shipping fleet, especially for dry bulk carriers. This has triggered a strong demand for new vessels that has exceeded the capacity of the world shipbuilding market to deliver those vessels, leading to lengthening order books and delivery periods. This in turn has led to a drying up of the normal recycling of older vessels, as shipowners keep them in service to capitalise on market opportunities.

In turn this strong demand for all types of vessels has created particular shortages in some ship types, which can sometimes be met by converting some vessels to meet that demand. This has particularly been the case in the dry bulk market, where demand has been particularly strong, and where, as shown in Figure 4, increases in time charter rates have been dramatic.

There was a significant increase in 2007 in the number of contracts that were being placed for the conversion of single hull VLCCs into VLOCs,[5] to the extent that it is being reported that ship conversion yards have become saturated. At the end of the 2007, there were over fifty VLCCs scheduled to start a "second life" as a bulk carrier in 2008 or 2009 as well as a number of Suezmax and Aframax vessels (BRS, 2008).

The volume of conversion work is expected to be substantial in the coming years, especially in Chinese yards such as the Cosco shipyard group.[6] For example, it was recently reported by Det Norske Veritas (DNV) that the conversion market is very active, and that it had classed about 40 re-deliveries[7] by the end of 2007, a trend it expects to continue into 2008.

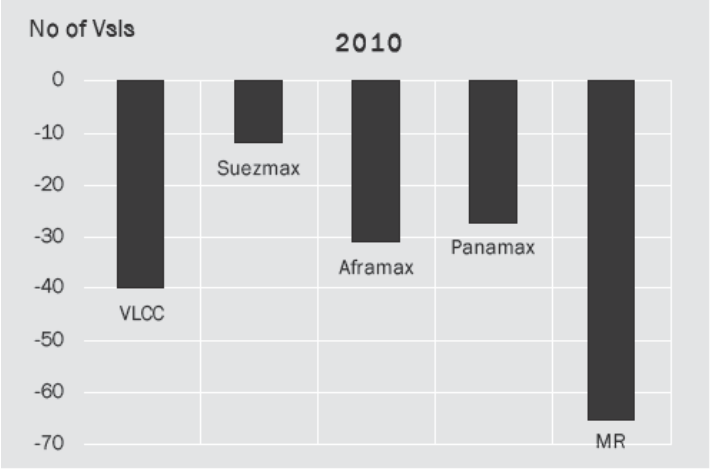
These conversions are expected to contribute to quicker rebalancing of supply/demand in the tanker fleet (which is oversupplied), and which still counts a sizeable number of relatively young single-hull vessels that could remain in service beyond 2010. On the other hand, these conversions will hasten the imbalance in the large bulker fleet (vessels over 120 000 dwt) as the many new-buildings on the order books

come into service, even though the majority of the new-buildings are not due to be delivered until 2009 (130 vessels) and 2010 (250 vessels). (BRS, 2008)

In addition to this pressure on the dry bulk market, there have been separate but parallel regulatory actions at the International Maritime Organization (IMO) that have impacted significantly on the market.

The loss of the tanker the "Erika" in December 1999 had a profound impact on the shipping industry. The IMO introduced new mandatory phase-out requirements which are contained within the new revised MARPOL Annex I Regulation 13G. Under this Single Hull Phase-Out Schedule, many single hull tankers are due to exit the fleet as early as 2010, although some will be allowed to trade past 2010 depending on their Condition Assessment Scheme and flag state regulations. The expected single hull exits in 2010[8] are shown in Figure 4 (MMA, 2007).

Figure 4. **Expected single hull exits in 2010**



Source: MMA, (2007), *Single & Double Hull Tankers*, Issue. 35.

This regulation has created a reservoir of single hulled tankers, capable of being converted for dry bulk operation, that represent a diminishing assett value to their owners, as well as incurring higher insurance costs. These tankers are prime candidates for conversion to bulk carrier operation.

The second development that has triggered higher demand for conversion service is related to the rapidly increasing price of oil. High oil prices and strong demand for oil are triggers for the bringing on-line of marginal oilfields, as these become more financially attractive. However, because of the lack of permanent oil extraction and storage infrastructure (which may be uneconomic to provide in small oil fields) many of these marginal oil enterprises will utilise Floating Production, Storage and Offloading platforms (FPSOs).

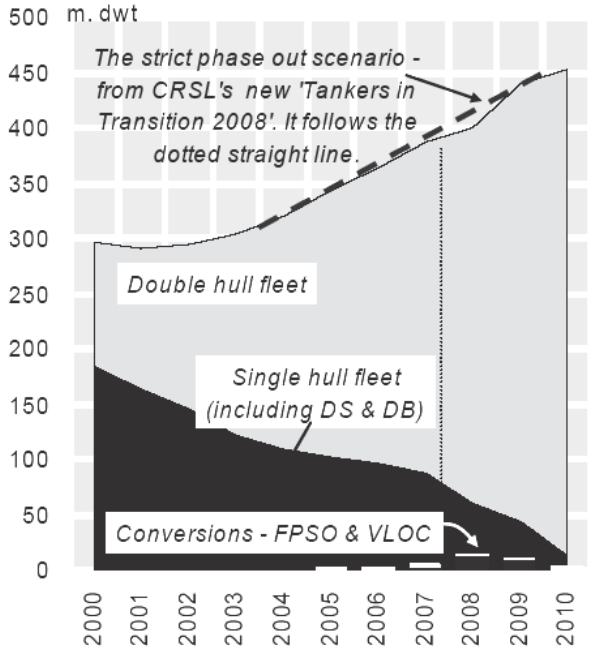
These FPSO take the place of fixed platforms and have the added advantage of being relocated relatively easily to take advantage of short term changes to the production opportunities and the oil market. These FPSOs can either be purpose built, or be converted oil tankers (generally the large vessels such as VLCCs – Very Large Crude Carriers).[9]

Since 2004, the world has experienced a period of high oil and gas prices. This trend injected new life into the offshore industry during 2007 (BRS, 2008). The search for more and more oil is driving technology forward, with much of the exploration and development work being undertaken in deep and ultra deep offshore waters. This has generated additional interest in FPSOs (dedicated and converted), as these are virtually the only methods of producing, storing and offloading oil using a single unit from marginal fields in deep ocean sites.

This has led to considerable interest in the conversion of single hull tankers to FPSOs or similar units for offshore environments. FPSO conversion contracts typically require in-dock periods of around 210-245 days per contract, considerably less than the new-build alternative. It has been estimated that between two-thirds and three-quarters of the units operating as FPSOs, FSOs, etc. are conversions, and the existing fleet numbers around 110-115 vessels.

However, there is also a view that the FPSOs of the future will need to be larger and more sophisticated, in order to incorporate more innovative designs and the efficient integration of operational and marine functions, and this may mean that the "simple" conversion of tankers might not be viable in the longer term (Drewry, 2002). Nevertheless, the conversion of single hull tankers into ore carriers and FPSOs is a significant development. In 2007, this absorbed 4 million dwt of tankers, but in 2008 it could be closer to 15 million dwt, and could drag supply below the demand trend line as shown in Figure 5 (CRSL, 2008).

Figure 5. **Conversion of single hull tankers**



Source: CRSL (2008), *Shipping Intelligence Weekly*, Issue 811, London.

Interactions between ship repair/conversion and shipbuilding industries

While there are some significant differences between the activities of shipbuilding, ship conversions and (particularly) ship repair sectors, there are nevertheless a number of similarities, and in many case all of these activities could be carried out in the same yard, as is the case, for example, at the Gdansk repair yard Remontowa.[10]

It is suggested that these similarities, rather than their differences, are the dominant elements that need to be considered when looking at possible interactions between these otherwise separate sectors, and these are considered in more detail below.

Location

In most cases the basic infrastructure required by the ship repair and ship conversion industries is generally similar to that of the shipbuilding industry, However, there are some special considerations between the sectors that may affect where those yards that specialise in one particular sector of the industry may locate their facilities.

Generally, shipbuilding has generally been regarded as the more capital intensive activity, and therefore higher in the value chain than ship repair. As such it has generally been the more attractive option for yards in the more developed economies, which made significant investments in major shipbuilding facilities. While this has increasingly been the case in the emerging economies, it is also true that their focus has been on ship repair/conversion, which was more suitable for the large number of small yards in those emerging economies, which although not technically advanced, could count on a significant supply of low cost, relatively skilled labour.

While yards that specialise in new-builds or major conversions would not be so sensitive to location (because of the discretionary nature of the contracts and the length of time that the work would take), those yards that specialise in the ship repair sector would have a distinct advantage if they were located close to major sea lanes or key loading/discharge points. This is because such strategic locations will minimise the amount of vessel down-time experienced by shipowners, and would make those repair facilities more attractive than those that are situated in less convenient locations. Examples of such strategic locations are Singapore, the Arabian Gulf and the Mediterranean.

Further, in order to take advantage of economies of scale, there is usually a clustering of shipbuilding and ship repairs industries at some specific locations. Within the leading shipbuilding economies there are dedicated shipyard clusters for shipbuilding and ship repair activities in order to achieve a more focussed work force and extract production efficiencies. Although this is not a hard and fast rule, the effect of this can be seen in Japan, China and South Korea, which are better known as shipbuilding economies, whereas Singapore, Dubai and Bahrain have emerged as ship repair centres.

Operational issues

One of the other critical differences between ship construction and ship repair (but to a lesser degree ship conversions) is that in ship construction any change in work pattern or schedule is avoided if at all possible, whereas in ship repair the expectation is that there will be change.

A ship construction project, once the design is sufficiently advanced, and assuming there is a well-organised production system in place, can be planned in detail with a high degree of certainty. This planning certainty means that in order to be as efficient as possible, new-building activities have become increasingly industrialised in their mode of operation, and have become more ship "assemblers" than ship "builders".

Therefore, the focus is increasingly on the control and management of all construction processes that are needed to maximise efficiency and reduce construction costs. This has brought to the fore crucial areas such as modularisation, information systems, logistics management, sub-contracting, working with external suppliers and adopting industrial rather than "workshop" methods of construction. As a consequence, the fabrication of components in shipbuilding is therefore increasingly outsourced.

However, such a rigid (albeit efficient) procedure cannot always be applied to ship conversions, largely due to the uncertainties that are inherent in such major vessel modifications, regardless of the pre-planning that may take place. Uncertainties about the condition of the existing structure and systems may mean that the conversion may need to be re-planned after the initial stages.

Therefore, by their very nature ship conversions will require considerably more internal flexibility to undertake a variety of tasks in-house, and the yard must retain many of the skilled workers and workshop facilities that shipbuilders are increasingly keen to outsource.

In many cases, conversion projects will affect the longitudinal strength, structural integrity and stability of the vessel. This will also require the yard to retain design and construction skills, as well as equipment and infrastructure, capable of dealing with significant structural changes to vessels.

The scale and complexity of many conversion projects mean that these operations are very similar to the building of new ships, and in some cases could also justify the techniques used in new-build yards, the outsourcing of a lengthening section of a hull, for example.

At the other end of the scale, for the ship repairer the operational challenges are far more complex. In the first instance, there are few routine jobs which can be used as a basis for productivity measurement. While work such as hull cleaning or painting can be based on the specification and area to be covered, the actual underwater hull condition, which is the starting point, may only be clear when the ship is docked. In addition, for many items the workload associated with the task is variable, so that once work commences there may be variations in the tasks, which result in significant variations in the man-hours needed.

This means than many "workshop" skills need to be kept in-house, which although making the yard more flexible (and therefore more able to respond quickly to unexpected circumstances) it also means that they would incur higher costs than their dedicated counterpart yards. Also, as dedicated repair yards they would have to keep a relatively high inventory of spare parts and components in order to minimise down time for ship owners who use their facilities.

Generally, it would seem that ship conversion activities are a bridge between pure shipbuilding and ship repair, although it seems to have much greater affinity with the former than the latter. It would also appear that it would be easier for shipbuilding yards to take on ship repairs than vice versa, but repair yards have been known to shift from

ship repair[11] to shipbuilding, as they have acquired better skills and improved their infrastructure. Some of the shared characteristics between the sectors are explored in more detail below.

Shared characteristics

The similarities between ship repair/conversion, and shipbuilding facilities mean that the conversion from one focus to the other, while complex in terms of repositioning the business, would not be impossible.

For example, shipbuilding yards take the opportunity of fluctuations in demand for new constructions by also offering repair and maintenance services. In some cases it also works the other way, as small and medium sized repair yards (in particular) might complement their repair activities by engaging in small-scale new-building activities, perhaps ferries, tugs and smaller commercial vessels, in order to cope with cyclical fluctuations in the repair and maintenance business. As an example, HMD-Vinashin[12] yard decided in 2007 to start building a series of Handymax bulkers in their yards, which until then had focused exclusively on repairs and conversions (BRS, 2008).

This flexibility in the positioning of yards depends to a large degree on the availability of facilities and skills in the yards, and the type, magnitude and complexity of work that these facilities and skills would allow. As explored earlier, dedicated shipbuilding shipyards are moving more and more into assembly, with more and more parts/components being outsourced. This would reduce the ability of such "industrialised" yards to effectively compete in the more flexible repair market (but this would be unlikely to affect their ability to move into the conversion sector).

From the opposite direction, dedicated repair yards might lack the design and logistics management skills and equipment/infrastructure to compete effectively against the dedicated shipbuilding yards, although they might be able to compensate for this through access to large amounts of low cost labour (and especially if the there is an excess of demand over capacity).

Table 2 shows the main facilities that might be common, or different, in two yards, one specialising in repair, the other in shipbuilding. It indicates conceptually the areas where one or the other would find themselves uncompetitive (or at least inadequately prepared) if a decision were taken to move from one activity to the other. Because of its greater affinity to shipbuilding than to ship repair, a ship conversion facility would share the greatest commonality with shipbuilding yards (Chabane, 2004).

Table 2. **Common facilities between ship repair and shipbuilding/conversion yards**

Facilities that are equally shared between two activities	
1. Paint shop	6. Health and medical service
2. Warehouse	7. Training centre
3. Lifting installations	8. Transportation station and parking
4. Administrative offices	9. Catering services
5. Technical services	
Facilities that might be shared with predominance of one type of activity	
1. Pipe shop (shipbuilding)	3. Berths (ship repair)
2. Steel shop (ship repair)	
Facilities that might be segregated and only dedicated to ship repair	
1. Docking area	4. Carpenter shop
2. Machine shop	5. Afloat repair shop
3. Electrical shop	6. Treatment plan
Facilities that might be segregated and only dedicated to shipbuilding	
1. Steel stockyard	4. Units and blocks storage area
2. Steelwork hall	5. Erection area
3. Outfitting centre	6. Design centre

Source: Compiled by the OECD secretariat.

What this table essentially shows is that there can be considerable differences between the yard facilities that could be expected to be found in yards that specialise in either construction (and probably conversion) or repair. This is not to suggest that this differentiation will be found in all yards, but that these differences are indicative of the kind of specialised "in-house" facilities that could be expected to be found in (or absent from) such yards as they head towards their particular specialisation.

One important aspect of the inherent differences between these different types of facilities is that yards that specialise in repair, with little need for advanced design capability, would find it more difficult to enter the new-building market where such capabilities are essential.

Conversely, a yard that as part of specialising in new-buildings outsources smaller steel fabrications, might find it more difficult to move to ship repair work where such a capability would be in constant demand because of the type of work that ship repair would entail.

Therefore, from the above it would be possible to conclude that while both ship repair/conversion and new building facilities share the same basic needs and characteristics, there are also some significant differences which means that they are not always totally technically, operationally and commercially interchangeable.

Like shipbuilding facilities, repair yards require a heavy financial investment. Dry docks are expensive, and most integrated repair yards also have two or more piers supplied with appropriate cranes, power, water and access which are a necessity for "alongside" repairs.[13] These items also need to be accessed by the dock or the shore position. The easiest and quickest means by which a repair facility can increase its capacity is through the acquisition of floating docks, which are inherently unsuitable for new constructions. Table 3 shows the basic specifications of dock systems (one of the most expensive infrastructure items in new-build and repair yard investment), including their operation possibilities in both repair and new construction (Drewry, 2002).

Table 3. **Main Ship repair dock systems**

	Slipway System	**Shiplift/Lift Dock System**	**Floating Dock**	**Graving (Dry) Dock**
Operational possibilities	Principally new construction	Repair/conversion and new construction	Normally, repairs and minor conversions only	Repair/conversion and new construction
Docking times	Approx. 1 hour	Approx. 30–45 min.	Approx. 1.5–2 hrs	Standard 6–10 hrs
Operation	Skilled personnel needed	Skilled personnel needed	Skilled personnel needed	Simple operation
Maintenance	Significant Breakdown of rails after long period of corrosion. Servicing of winches	Minor Limited corrosion of platform as submerged only during docking	Considerable Protection of the steel structure against corrosion is necessary	Minor Locking gates, pumps etc.
Service Life	10–15 years	25 years	15–20 years (if well serviced)	30 years

Source: OECD Secretariat; Drewry (2001), *Global Shiprepair – Market Outlook to 2005,* Drewry Shipping Consultants Ltd., London.

While some of the workshops in both shipbuilding and repair yards would be almost identical, in some instances workshop extent, layout and design would differ depending on the target vessel types for the facility. The optimum yard layout for any particular repair site is not something that can be drawn from a specific template, due to different sites and management strategies, geographical location and support industries.

In addition, repair yards must have a wider variety of tools than those required by shipbuilders, since each repair job can be unique. On the other hand, ship repair yards do not need to invest as heavily in major capital equipment as shipbuilding yards, and any such investment undertaken is more directly connected with the prospect of using those facilities for ship construction when shipbuilding demands makes a shift in focus economically viable.

Regional activities in ship repair/conversion

This paper is not intended to be an exhaustive analysis of the ship repair and conversion sectors, but to be an overview of the interactions between these largely service sectors and the shipbuilding industry. Nevertheless, an attempt has been made to lay out some of the major regional activities involving ship repair and conversion, in order to provide a basic understanding of where activities are focused, and what major groupings are functioning.

Europe

European repairers, faced with strong competition from lower cost repairers in Singapore, China and the Middle East, have focused their attention on intra-regional markets, as well as more complex conversion and specialist activities. Privatisation, restructuring, and a shift to more flexible work practices encompassing a greater degree of subcontracted work, have characterised European repair developments since the 1990s (OSC 2002). Emphasis on quality, expertise, and tight scheduling has also helped bolster repair/conversion activity among some European yards.

Repair facilities based in the Mediterranean are also likely to face increased competition from expanding yards in the Black Sea, as well as yards in Asia. Whilst it is expected that general repair work will continue to form the core of Mediterranean yard activity, a number of those yards are expected to expand into more specialist services, such as the focus by the Italian Fincantieri group on repair/conversion (particularly for cruise vessels) at its dedicated yard in Palermo.

The opening up of Central and Eastern Europe since the early 1990s has added to the supply of repair/conversion facilities, especially as state owned facilities have been progressively privatised, thus enabling them to greatly increase the range of services offered. While these new yards brought a measure of low cost competition on the European scene it appears that some are already losing their cost advantages to newer entrants, and it was recently reported in Lloyd`s List[14] that ship owners are now weighing up sailing times if they are considering Baltic or Polish yards, since it could be more economical to have maintenance and repairs done closer to their main trade routes.

Middle East

In the Middle East, particularly in the UAE and Bahrain, there has been considerable investment in facilities and the importation of labour from low cost regions such as India, Pakistan and the Philippines, to build up a competitive ship repair industry. The yards at Dubai and Bahrain are able to capture many of the tanker vessels that converge there, as well as ships supplying commodities to the Gulf States. On a percentile scale,[15] if the cost of ship repair in the Middle East is set at 100, costs are estimated to be 250 in Japan, 150 in Europe and 50 in China.

It has recently been reported by Lloyd's List that construction of the Ras Laffan ship repair yard project[16] in Qatar is making tangible progress, with the 43ha repair yard primarily focusing on servicing LNG carriers. However, the intention is that it will also service and repair a wide range of vessels, as well as conversion of tankers to FPSO and FSOs.

Asia (excluding China)

South Korea, perhaps benefiting from the restructuring that followed the Asian financial crisis in the second half of the 1990s (when the Won lost about 40–50% of its value in four months), has maintained a successful balance between ship repair and new-building activity and continues to broaden its capability to handle a broad range of commercial vessels.

On the other hand, *Japan's* higher labour costs have made it less competitive in the repair market than the competition in China, Korea and Singapore, and it is understood that this has led Japanese repair yards to concentrate on domestic niche markets (see Table 4), where efficiency and automation, rather than simply low costs, can give them a competitive edge. By doing this Japan will maintain a strategic level of ship repair capability, even though the market share of its shipbuilding industry has declined following its dominance in the 1970s and 1980s.

Table 4. **Japanese ship repair industry – domestic/foreign vessels**[1]

Year	Domestic vessels		Foreign vessels	
	No.	Sales (mil JPY)	No.	Sales (mil JPY)
1997	31 094	150 955	1 697	27 995
1998	29 494	162 105	1 598	25 860
1999	28 605	110 ,804	1 598	24 568
2000	26 821	101 960	1 460	19 714
2001	26 130	94 861	1 403	22 784
2002	23 477	87 220	1 145	23 194
2003	21 505	120 107	967	18 610
2004	20 353	135 724	1 135	23 728
2005	19 003	79 309	944	21 162
2006	18 681	78 251	823	26 152

1. Vessels over 20 GT and 15 meter length counted.

Source: Japan Ministry of Land, Infrastructure and Transport.

Singapore has traditionally been a very active ship repair and conversion centre, its dedicated yards benefiting from its strategic position in one of the busiest sea-lanes in the world and the popularity of its port (also one of the busiest in the world). Its reputation for high quality work and its unparalleled location are key factors for Singapore continuing as a significant repair/conversion centre in the future. In addition, there is evidence that Singapore yards are increasingly looking at new-buildings to diversify their activities.

Also, Singapore has sought to maintain its leading role in ship repair by entering into alliance agreements with major ship owners and operators, and attempting to retain its long-standing reputation as a relatively low cost centre by hiring labour from lower cost sources such as China, Malaysia, India and the Philippines.

A number of Singapore facilities which may be uncompetitive at basic ship repair activities are key players in specialist sectors. An example is Sembcorp Marine, which while probably being at a cost disadvantage in conventional repair work compared to rival yards in lower cost centres, has used its expertise in offshore conversion to retain a strong market presence.

*Viet Nam i*s the most significant of the recent entrants in the world's shipbuilding market, and is attracting considerable investment from foreign investors into its yards because of the support from the Vietnamese government, the availability of infrastructure and its large pool of skilled, low-cost labour.

While it is understood that the majority of this foreign involvement is focused on new-building facilities, there will be an inevitable flow-on effect on other Vietnamese facilities, especially the older ones that may no longer be attractive for new-building construction, but which may find a niche by providing repair and conversion services.

While *India* has not traditionally been considered as a ship repair/conversion centre (except for domestic users) it has been published in the report "Working Group for Indian Shipbuilding and Ship Repair Industry for the Eleventh Five Year Plan (2007-2012)" by the Government of India, that the existing docking facilities had not grown to meet the

requirements of modern tonnage. This meant that with the commencement of new refineries on the Indian coast, the number of VLCC's used on those trades is bound to increase, with growing potential for the docking of such vessels. Moreover, it was reported in this report that the proximity of Gujarat to the adjacent Middle East oil fields could also attract substantial tanker repair business (IMS 2007).

China

Since the opening up of the Chinese economy there has been considerable expansion in its repair and building capacity on account of low labour costs and investment incentives. Chinese yards are also continuously improving quality, expertise, and productivity and broadening the range of work that they can undertake.

During the last decade, there has been evidence of an increasing Chinese yard presence, with some FPSO conversion work also being undertaken. As far back as 1996, the Shanhaiguan yard was involved in FPSO conversion work, under sub-contract to Hyundai HI. This yard and others, such as Sembawang Bohai, Qingdao Beihai and Yantai Raffles, continue to operate successfully in the offshore sector for rig work and/or FPSO/FSO related work. (SRJ, 2007).

Foreign investment in Chinese repair facilities is set to expand, with established repairers in Hong Kong, Singapore and Japan seeking joint-venture projects in order to establish facilities supported by a low cost base. Ongoing investment in facilities and skills is set to sustain long term growth and increase the volume of higher value repairs and conversion contracts.

Nevertheless, despite this investment in both repair and new-building capacity, China's repair yards are all experiencing very high levels of utilisation and are also experiencing shortages of skilled labour that are affecting the industry as a whole at the present time, and will need to reach further into its labour pool in order to find skilled employees.

Significantly, from a structural perspective, it has been recently reported by Lloyd's List that the COSCO Shipyard Group[17] is looking to acquire ship repair yards overseas in order to overcome rising costs in China, rather than develop new greenfield sites. However, it is not clear where such expansion in the repair area would take place. Recent experience involving other economies suggests that South-East Asia could be a target, as Hyundai has entered into a joint venture with Vinashin in Viet Nam, and Singapore's Keppel Shipyard has ventured to the Philippines with investment in three yards there.

In June 2007, a new 300 000 dwt dry dock was completed at Cosco Zhoushan yard in China, following the opening of a new 80 000 dwt dry dock that was commissioned in March 2007. As a result of these two projects, Cosco has picked up a series of major conversion contracts such as VLCC to VLOC and FPSO conversions. As a result of these investments the group's annual repair capacity increased to 1.7 million dwt, an increase of 28% compared with the position at the end of 2006.

Indeed, 2007 was a very significant year for China's ship repair and conversion industry, with the country's largest single repair yard now in operation on Mazhou Island in the Pearl River delta, near the growing port of Shenzen. Operated by the well-established Chinese ship repairer Yiu Lian Dockyards, the new USD 292 million repair facility, which covers an area of 700 000 square metres, opened in May 2007 when its

3 000 metres of repair berths became operational. The facility's core business will be repair and conversion, primarily of VLCCs, as well as specialised containership repairs.

Moreover, it has been recently reported by COSCO Corp (Singapore),[18] a subsidiary of China's largest shipping group, that ship repair and conversion operations have started at its new joint venture shipyard Lianyungang in Jiangsu province. The yard comprises three 220 m long berths, an 80 000 dwt capacity floating dock and covers 220 000 sq m. A further eight berths will be developed in four phases by 2011 at Qidong in Jiangsu province, following a land purchase deal with COSCO Nantong Shipyard agreed in January 2008.

Other geographic areas

While there are other minor centres where ship repairs and conversions are undertaken, these tend to be either high cost, domestically oriented, or lack the technical expertise to attract significant outside contracts. Australia/New Zealand, Africa (especially South Africa) and central and South American facilities tend to fall into one of these categories.

In the US, the repair industry continues to be focused on captive Jones Act vessels (as is its new-building industry) as well as offshore and cruise ship work (the latter associated with the US and the Caribbean as the world's largest cruise ship market).

The role of governments

Traditionally ship repair activities have been largely national rather than commercial in nature, with considerable public sector ownership of facilities which could be used or leased by one or several repair companies. However, in recent decades this picture has changed, due to the privatisation of state run operations, the possibility of establishing joint ventures to bring outside commercial capital and expertise into state facilities, and business consolidation.

Also, the more liberal investment rules and the opening up of access to lower cost locations have led the creation of wider and more complex business arrangements that have reached into regional and global markets.

While it was clearly governments that began this liberalising process, it is actually quite difficult to establish what their ongoing role is in the development of the ship repair and conversion sectors. It is known that while government support for the shipbuilding sector generally has decreased, there are still significant financial and other incentives provided to the industry (for details, see the OECD Inventory of Subsidies and other Support Measures).

However, the focus of data seems to be on the new-building sector, and it is virtually impossible to establish what proportion of this assistance (if any) is directly provided to the ship repair and conversion sectors. It may be that with many yards working in both sectors such distinctions may be difficult, or indeed impossible, but the point here is that this is unknown, and so too (by consequence) is the true role of governments in the sectors.

Governments may give assistance to the ship repair industry and shipbuilders in a variety of ways such as direct subsidies, tax incentives, cheap credits and restructuring assistance. Governments also heavily support R&D and innovation programmes, and

while these are probably mainly related shipbuilding activities (where the benefits of such activities are more likely to accrue), some might also concern repair and conversion activities, due to the commonality of many processes and techniques.

Governments should have considerable interest in ship repair and conversion activities because of their significant potential for direct and indirect employment of labour. Unlike shipbuilding where almost 70% of the equipment and materials (including steel) in terms of value are imported, the reverse is the case in ship repairs where almost 100% of the work is done locally. Therefore, in many economies governments apply some measures such as soft loans, exemption from service tax, relief from custom and excise duties and others in order to support those activities (see IMS 2007 for an example).

However, an intensive search for specific government objectives and targets for the ship repair and conversion sectors, as well as details of direct or indirect support provided to them, has failed to find any significant information sources. This could be because the shipbuilding sector is treated as a homogeneous activity, with no distinction between new-buildings, conversions and repairs, or that the repair/conversion sectors tend to be less visible and are not separately accounted for. While the former is more likely to be the case, it might be significant that even in the case of the extensive statistics collected and published commercially, most of them fail to provide regular data on their outputs – including quite significant conversion activities. This might be fertile ground for further investigation in the future.

Possible future issues in the repair/conversion sectors

Because it is so difficult to find information related specifically to these sectors of the broader shipbuilding industry, this section is necessarily brief and relatively speculative, and has been drawn from snippets of information collected in the course of preparing this analysis.

It has already been established that the demand for ship repair services is directly related to the size of the world's fleet (particularly for programmed maintenance), and that this is currently rapidly growing, a situation that is unlikely to be affected (at least in the short to medium term) by the present financial problems precipitated by the US sub-prime problems.

The choice faced by owners as to which repair facilities to use will remain broadly similar, and will centre around price, location or specific specialisation. However, it is understood that, since the introduction of tougher safety regulations by IMO and the introduction of the International Safety Management Code for the Safe Operation of Vessels,[19] many owners are now looking more seriously at the quality of repairs (NG 2003).

It is possible that ship repair yards could be asked to provide stronger guarantees of steel work in the near future, since steel quality and the need for guarantees of work for up to five years are early suggestions coming out of the IMO debate on goal-based standards. The issue of the quality of steelwork is also being discussed as part of a research project looking at the effects of repairs on tankers, which is considering how the effects of a repair can change over time, and how they may create unknown and unpredicted stresses on a ship's hull.[20]

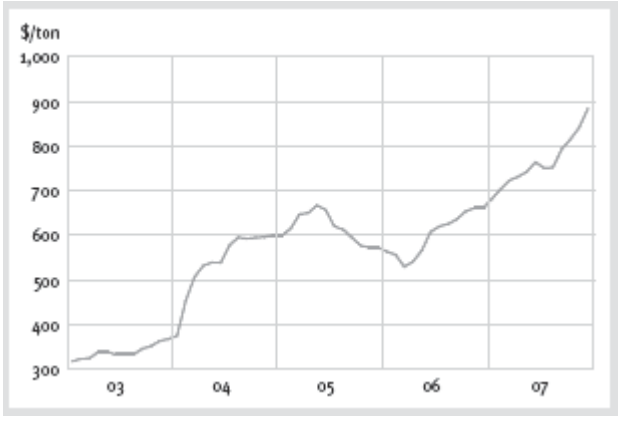
Developments such as these, aimed at establishing minimum quality standards for ship repairs, could be a significant factor in the future, and may act to strengthen the appeal of some of the more traditional repair/conversion facilities in higher cost locations. At the very least, facilities that offer low cost repair/conversion services will have to ensure that they can meet these future requirements.

The conversion sector is less predictable, but it can be anticipated that once the 2010 target for the removal of most single hulled tankers has been reached, then the ready supply of vessels that would otherwise be approaching their shelf life will dry up. This will probably severely limit future demand for the conversion of tankers to bulk carriers.

As noted earlier in this report, some issues are already being raised regarding the future suitability of FPSO conversions to meet the higher standards and capabilities demanded for their operation as floating oil platforms. In any event, as the demand for new-buildings slows, as it is doing right now, then this will free up new-building yards to undertake the work, and the falling demand, together with rapidly growing shipbuilding capacity, is likely to also bring down the cost of newbuilt FPSOs.

It is also pertinent that it has been reported by Lloyd's List[21] that owners of single-hull tankers are starting to review the economics behind conversions to very large ore carriers, due to the rising cost of steel for the conversions (see Figure 6), and the higher prices being paid for vessels offered for demolition. As an example of the latter, the price paid by vessels recyclers in Bangladesh for tankers recently increased to USD 715 per ltd,[22] around 25% more than the USD 500 per ltd price on offer at the start of the year.

Figure 6. **Heavy steel plate export price, 2003-2007 (10 mm+)**



Source: Platou (2008), *The Platou Report 2008*.

Measuring future demand for ship repair services is difficult because while some maintenance and inspection activities are predictable and can be programmed, others due to breakdowns or incidents are not, and need to be undertaken at short notice. Also, demand for repairs is governed by the need to balance the laying up of vessels to keep them in a seaworthy condition, with the necessity of remaining commercially operational to meet market demands. Crucially, all of these elements are subject to variation and tend to be in a state of flux. However, despite this unpredictability, in an aggregate sense demand for ship repair services is related to demand for shipping services and the development of the world fleet, and this permits some general trends to be drawn from developments in the markets.

The Shiprepair and Conversion Technology Journal reported that 2007 saw a remarkable upsurge of underwater repair work globally, particularly in the commercial sector, which traditionally has been more reliant upon dry-docking. The range of repairs undertaken without dry-docking has also increased, and has included work such as the fitting of anodes[23] and complete hull plate repairs by means of underwater welding, as well as hull cleaning of yachts, naval vessels, commercial ships of all sizes and FPSOs. These developments will have the effect of easing pressure on dry-dock facilities at times when high demand for the construction of new vessels tends to absorb these facilities, even those that tend to specialise in repair and maintenance work. The successful continuation of these innovative practices when pressure on dry-dock facilities eases (as it almost certainly will, as demand for new-buildings is falling) will depend on whether these specialised services can remain technically and economically attractive.

Citigroup Global Markets reported that Asia, in particular, is set to accelerate its phase-out of single hull tankers, which might cause an increase in conversion activities.[24] This is largely as a result of higher insurance costs and tighter regulations following the recent Hebei Spirit oil spill in South Korea, as well as to the high volume of soon-to-be-retired single hull VLCCs operating in the region (Lloyds List, 2007).

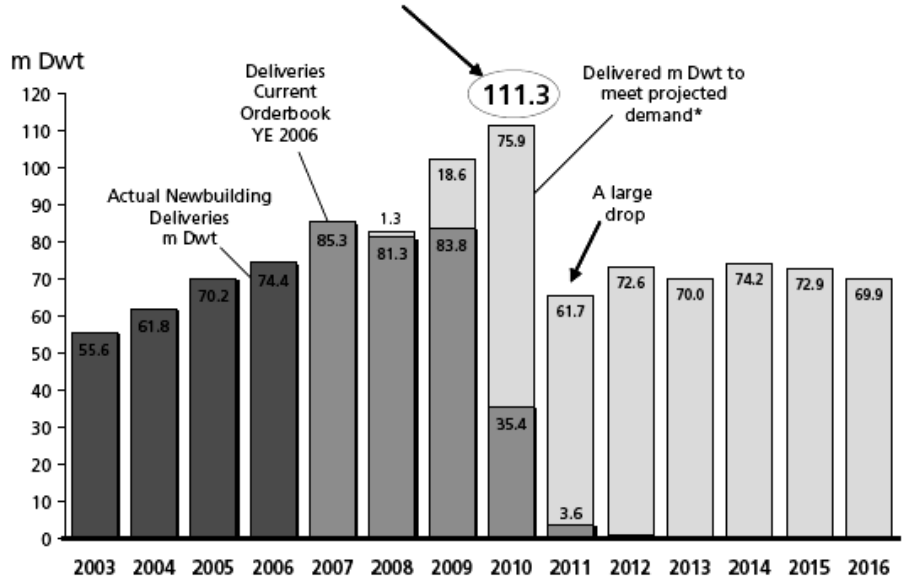
The transition of repair/conversion yards into new-building work

A dilemma faced by shipbuilders when demand falls is what to do with underused facilities. Many will take on smaller work or use them as repair facilities in order to keep them operational until demand for new-buildings picks up.

Of course, when the opposite happens (that is, demand picks up, placing pressure on production facilities), many of these transient yards would quickly revert back to their prime objective of building new vessels. If the increase in demand is significant enough this would also place pressure on those yards largely dedicated to ship repair and conversion to change their focus in order to meet the excess demand. There is every indication that this effect has indeed operated in the present, extended period of high demand pressure.

The latest shipbuilding boom has now extended for most of this decade, and as postulated in Figure 7 has virtually doubled the rate of deliveries per year between 2003 and 2010 (although demand is expected to soften – to a still historically high level – from 2011 onwards) and represents an almost ten-fold increase in demand since the late 1980s (ABS, 2007).

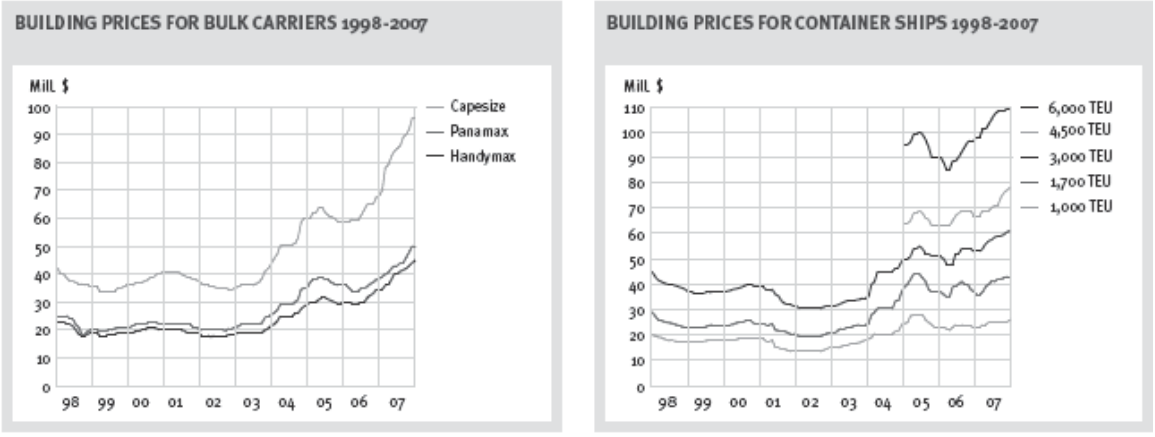
Figure 7. **Historic and projected deliveries – mdwt**



Source: ABS (2007) *Activities – September 2007,* American Bureau of Shipping report.

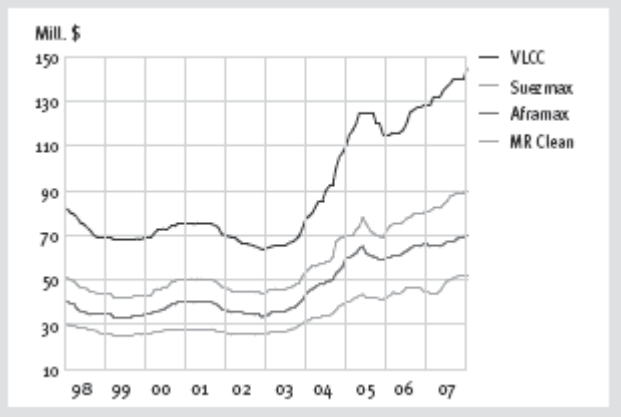
As a result of this sustained high demand for new-buildings, prices have also climbed significantly, making the entry into the construction of new vessels more attractive (Figures 8 and 9).

Figure 8. **Bulk carrier and container ships building prices, 1998-2007**



Source: Platou (2008), *The Platou Report 2008*.

Figure 9. **Tanker building prices, 1998-2007**



Source: Platou (2008), *The Platou Report 2008*.

Shipyards responded to this market opportunity by expanding their facilities, investing in new greenfield sites, and increasingly moving from ship repair/conversion to construction, in order to add to their building capacity. In turn this has had the effect of tightening the market for those types of services, and there is concern that the level of transition by ship repair/conversion yards into the new building market is seriously affecting the ship repair market.

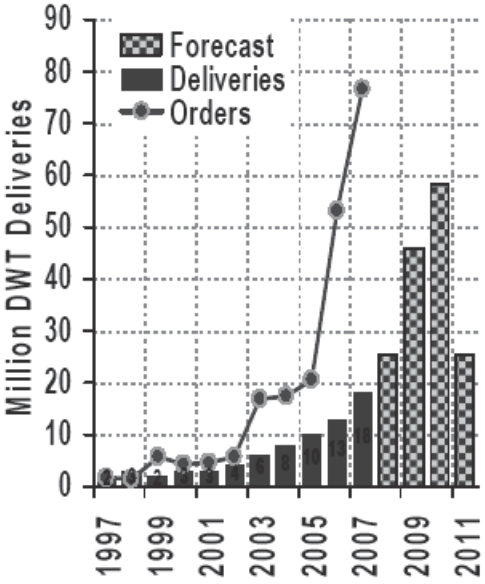
The most visible sign of the shipbuilding boom is the rush to expand facilities, convert ship repair yards and build new yards in China, which has rapidly increased its order books to the extent that it expects to become the largest shipbuilding economy within the next decade, if recent trends continue.

New shipyards have been opening up in China almost on a monthly basis in order to offer early deliveries of bulk carriers. Based on the delivery dates in its order book, China will deliver 25.3 million dwt in 2008; 45.9 million dwt in 2009 and 58.3 million dwt in 2010, which if achieved would propel China to the top of the shipbuilding league (Figure 10). (Stopford, 2007)

As an example of this, Cosco Shipyard Group (CSG), which until recently specialised in repair and conversion, has decided to move heavily into the new-building market,[25] with the group envisaging the opening of several construction sites at Dalian, Zhoushan and Guangzhou.

Also since 2002, as one of the signs of Chinese repair yard transformation into new-building activities, there have been 29 VLCC[26] docks either created or planned for construction by 2010, whereas there were only three docks built before 2002 as shown in Table 5. (BRS, 2008)

Figure 10. **China Shipbuilding deliveries, 1997-2011**



Source: Stopford (2007), *China's Economy and the Global Maritime Industry*, Senior Maritime Forum, Shanghai.

Table 5. **VLCC docks in China**

Yard name	Before year 2002	Year 2002-2007	Planned	Ownership
Behai	-	-	2 (2008)	State owned
Bohai	-	1	1	State owned
Cosco Dalian	-	1	-	State owned
Cosco Zhoushan		1	1 (2008)	State owned
Dalian New yard	1	2	-	State owned
Dalian yard	-	1	-	State owned
Guangzhou Long Xue	-	2	-	State owned
Jiangnan Changxing	-	4	-	State owned
Jinhaiwan	-	2	-	Private
NACKS	1	1	-	Private
Nantong Rongsheng	-	3	1 (2008)	Private
New Century	-	2		Provincial
Hudong Zonghua	-	1	-	State owned
Qingdao Beihai	-	2	-	State owned
SWS	-	2	-	State owned
Yantai Raffles	1	-	-	Private
Total	3	25	4	

Source: BRS (2008), *Shipping and Shipbuilding Markets*, annual report.

There are some signs that, especially in China, there is concern that significant bottlenecks will appear in ship repair activities, and some specific remedial action has begun. For example, Chinese Titan Quanzhou is currently active in the shipbuilding sector only, but the yard is building a major new repair facility which should be operational by 2009. It is expected to be capable of carrying out VLCC repairs and FPSO conversion projects. (SRJ, 2007)

It has also been reported by CSG (COSCO Shipyard Group) that the Lianyungang yard in China will boost the group's ship repair and conversion capacity, which has been

reduced during the past year as it shifted into the shipbuilding business. Following its move into shipbuilding at the beginning of 2007, CSG has captured some USD 3.4 billion worth of orders for 84 new-buildings during the year, taking up a good portion of its ship repair capacity. Some owners have confirmed fears that there could be a shortage of ship repair capacity as more and more yards opt for higher value new-building work.

Another example of the movement of yards from ship repair to shipbuilding is Hong Kong based IMC (International Maritime Carriers) Group, which is expanding its shipyard business in China with two new yards,[27] one focusing on ship repair and the other on shipbuilding. IMC is already in the ship repair business in Thailand with Unithai Shipyard and in China with Zhoushan IMC-Yongue Shipyard.

However, as a final point, the dramatic increase in world shipbuilding capacity may turn out to be excessive if demand softens in 2011 as is widely expected, which will almost certainly mean that many of those repair yards that progressed to shipbuilding may start reverting back to their core functions at about that time.

Summary and conclusions

The principal purpose of this paper was to explore the interaction between the ship repair, ship conversion and shipbuilding industries, and was not intended to be an in-depth analysis of the ship repair and conversion sectors themselves.

While the differentiation between ship repair and conversion is somewhat fuzzy and artificial, because of the ability of dedicated yards to move from one activity to the other, or even undertake the different activities simultaneously, there are nevertheless some observations that can be made about them.

For ship repair (including scheduled maintenance activities), the rapidly growing fleet will provide the foundations of an on-going base work load providing services for that fleet.

This strong demand may encourage yards to retain skills and operational flexibility to continue to specialise in the repair market, but it can also be expected that conversion and construction yards to enter the repair market if demand for conversions and new buildings declines (as it is expected to after 2011).

On the other hand, on current trends, the ship conversion sector has a somewhat uncertain future. First, the availability of single hull tankers (which have formed the mainstay of ship conversion activities) is likely to dry up as the IMO deadline for their being taken out of service approaches. In addition, the continuing high price of steel may also entice owners to recycle their old vessels rather than risk a conversion.

Second, even if some availability remains there are indications that the bulk carrier fleet (which has absorbed many conversions) is likely to become saturated, especially if new-building slots become more freely available as new-building demand falls.

Third, even the conversion to FPSO may diminish in the near future, as more marginal fields come on stream that will require more sophisticated and versatile FPSOs than can be economically provided through the conversion of old tankers.

This may also place considerable pressure on yards that are largely dedicated to conversion work to consider their future, and the decision to remain in conversion, or switch at least some of their capacity to new-building or repair, will not be easy.

The transition of repair/conversion yards to new-building work to take advantage of the very high demand in recent years has been covered in the report. Whether such transitions can survive in the longer term is a significant issue, but not one that could be examined in detail in this paper.

However, the implications of this, that repair, conversion and new-building yards have sufficient similarities that enable them to move from one sector to the other, open up another interesting area, which is what does such flexibility do for overall shipbuilding capacity?

While dedicated shipbuilding facilities are clearly the most important in establishing the magnitude of shipbuilding capacity, it would seem that the ability of other yards to move in and out of new-building activities would have some impact on the overall capacity of the shipbuilding sector, and should not be ignored.

One area where this concept might be particularly important is negotiations on a new Shipbuilding Agreement, which were deferred in September 2005. In those negotiations the issue of whether the ship repair sector should be covered by the Agreement (as it was in the 1994 Agreement) was unresolved, and perhaps this analysis will provide some additional material and viewpoints for consideration when those negotiations resume (presuming they do).

Notes

1. It is accepted that labour and steelwork related costs are the two main components of ship repair costs, and that labour accounts for between 50% and 70% of total costs.
2. Only around 680 000 dwt of dry bulk capacity was sold for demolition in 2007, consisting mostly of handysizes and smaller units.
3. *"*Moving up the value chain or regression*", Worldyards* research comment 31/10/07.
4. Ships longer than 300 m in length and wider than 36 m in beam.
5. VLCC = Very Large Crude Carrier, VLOC = Very Large Ore Carrier
6. It operates a network of five yards in China and consolidates its position as the primary provider of ship conversion services.
7. *"DNV makes safety pledge on single hull conversions",* Lloyd's List 14/11/07.
8. It has been assumed by Mcquilling marine transport that approximately half of the vessels due to exit the fleet will pass the Condition Assessment Scheme (CAS), and trade beyond 2010.
9. The world's first floating platform was a converted tanker installed in 1976 off Castellon in northern Spain. At that time off-shore technology was still in its infancy and the tanker market was struggling due to escalating oil costs caused by the Middle East conflict, which also shut the Suez Canal.
10. The yard was established in 1952 and privatised in 2001. Remontowa S.A. specialises in ship repairs and conversions, design and construction of new ships, offshore units and steel structures.
11. On the other hand, developing economies like India and China have found that ship repairs are not only attractive, but also useful to generate employment and as a source of regular revenue.
12. Hyundai Vinashin Shipyard Co., Ltd. (HVS), founded in 1999 as a service shipyard that serves multiple repairs and conversion.
13. In ship repair, it can be assumed that on average 70% of the work can be done when the ship is lying in the water, and that the ship has to be dry-docked for only 30% of the work.
14. *Shipdock at full speed with repair work*, Lloyd's List 28/03/08.
15. Reported in Lloyd`s List 21\04\08 in the article *Albwardy to benefit from its partnership with Damen*.
16. *Ras laffan shiprepair project is on course*, Lloyd's List 23/04/08.
17. *COSCO shipyard group looking to acquire overseas shiprepair yards*, Lloyd's List 22/02/08
18. *COSCO corp sees robust profit growth*, Lloyd's List 02/05/08.

19. This is known as the International Safety Management (ISM) Code and applies to all types of vessels of over 500 gross tons, including mobile offshore units.

20. Reported in Lloyd's List 16/10/07 in the article *Yards encouraged to guarantee standard of steel repair work.*

21. *VLCCs head for breakers as demo prises soar*, Lloyd's List 10/03/08.

22. LTD = light ton displacement. It is a generally used measurement to calculate the scrap value of a vessel.

23. Anodes are fitted under on the water hull area for the external cathodic protection of vessels.

24. South Korea and India are the only countries to have increased the number of single hull, very large crude carriers on charter in the last two years, and nearly 96% of single hull VLCCs now trade in Asia, due to tighter rules in the USA and Europe.

25. Reported in Lloyd's List 22/02/08 in the article *COSCO shipyard group looking to acquire overseas shiprepair yards*.

26. VLCC = very large crude carriers.

27. These two new yards will be located in Zhoushan and Dalian Chengxing.

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The shipbuilding industry in China

Yin-Chung Tsai*

This report on the shipbuilding industry in China is one in a series of reports to provide an insight into the shipbuilding sectors of both OECD members and non-OECD economies.

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Introduction

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 19th century. However, as wood was replaced by iron and steel in the 1850s, 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 falls in orders, a trend that was exacerbated 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. While there was a strong recovery in the 1990´s, the European yards were not able to fully benefit, and yards in the Far East achieved the dominance that they still enjoy today.

The present development of the Chinese shipbuilding industry follows a similar pattern to what had happened earlier in Japan and Korea. Japan used its shipbuilding industry in the 1950s and 1960s to rebuild its industrial capability, while Korea saw shipbuilding as a strategic core for its economic development in the 1970s (Ludwig and Tholen, 2006). China is now also taking that development path by taking full advantage of the demand shift towards centres of low cost production, and making full use of its low cost advantage and large domestic demand to build a solid industrial foundation.

China has experienced a period of growing prosperity and stability since the introduction by the Chinese Government of the Open Door Policy in 1978. This was a comprehensive programme of economic reforms, modernisation and social development, and China has now emerged as a significant global economic power. Its shipbuilding industry has grown significantly and is now placed second or third in the world market behind Korean and Japan.[1] Substantial new shipyards are being built and massive investment in research and development is leading to increasing sophistication in the types of ships being built.

Snapshot of Chinese shipbuilding industry development

The development of the Chinese shipbuilding industry is often compared to the development of the industry in South Korea, but the conditions for the process of development differed considerably. While, the South Korean shipbuilding industry was aimed from the outset at producing vessels for export, in contrast the economic strategy in China has initially been to develop shipyard capacity to sustain domestic economic development. In other words, the substantial construction of shipbuilding capacity in China has primarily been aimed at enabling China to be self-sufficient in sea transport. Above all, from the Chinese perspective, the supply of raw materials for domestic manufacturing, meeting the food needs of its populations and the transport of exports should to the extent possible be undertaken by Chinese-built ships. However, China has for some decades actively explored the international market, and the trend in the mix of vessels being constructed indicates that the share of that market captured by Chinese shipbuilders is continuously increasing.

In terms of yearly output, in 2007 China maintained its position as the world's third-biggest shipbuilder, a rank it has held for over a decade. Overall, Chinese shipbuilders produced 10.4 million gt of new vessels in 2006, or around 18.4% of the world total, compared to 4.7% in 2000. By comparison, in 2007 Korea produced 35.7% and Japan

30.6% of the world total (on a gt basis) (Lloyd's Register – Fairplay 2007, and Lloyd's Register 2000). In 2006, the top two shipbuilding conglomerates, the China Shipbuilding Industry Corporation (CSIC) and the China State Shipbuilding Corporation (CSSC), reported a yearly output of 6.02 million dwt and 2.67 million dwt respectively (COSTIND, 2007).[2]

Figures as of September 2007, compiled by World Yards database, showed that the top ten Chinese shipbuilders accounted for around 12.7% of the global shipbuilding market. Dalian Shipbuilding Industry (CSIC) and Shanghai Waigaoqiao Shipbuilding (CSSC) became world top ten shipbuilders,[3] joining a list that before had been the sole domain of Japanese and South Korean companies (World Yards Report, 2007). The types of ships made in China have also diversified from conventional bulk carriers and crude oil tankers to high value and sophisticated vessels, such as very large crude carriers (VLCCs), liquefied natural gas carriers and high-speed container ships (COSTIND, 2007).

With respect to new orders, Chinese shipbuilders reported new orders totalling 58.0 million gt in 2007, to bring the total ship orderbook to 97.8 million gt, which represented 29.7% of the global share (Lloyd's Register – Fairplay December 2007). In accordance with its national shipbuilding blueprint, China expects to be the world's biggest shipbuilder by 2015.

Geographic distribution of principal construction facilities

There is no reliable, publicly available information about the number of Chinese shipyards, but it is estimated to be more than 2 000 (COSTIND, 2007). According to the 2007 yearbook of the shipbuilding industry of China, there were around 430 significant shipbuilding enterprises in 2006, which include all state-owned shipyards and those private shipyards whose sales revenue is larger than 5 million yuan.[4] A detailed list of China's major shipbuilding and repair yards is in Annex I.

China has a long coastline, as well as many rivers. Its mainland is edged by the Bohai Gulf, the Yellow Sea, and the East China and South China seas. The Chinese shipbuilding and ship repair industry comprises a large number of yards ranging from those capable of building VLCCs to the numerous very small yards generally building small boats and local craft. These yards cover a wide geographical area, both coastal and inland, reflecting the development of marine industries along the major river systems.

However, widespread shipbuilding and repair activity tends to be concentrated in specific locations. The most significant of these are Shanghai, followed by Guangzhou and Dalian. Shipbuilding facilities have also particularly focused at the mouths of China's two main rivers – the Yangtze and the Pearl, with some inland development along these waterways. Some limited development is also to be seen on the eastern coastline between these two main rivers. In Northern China, shipbuilding has tended to concentrate in the coastal areas bordering the Bohai Gulf and the mouth of the Yellow River.

China's largest shipbuilding cluster is located in the Yangtze River Delta region. The Yangtze River, the longest river in China, rises in the far West and ends at Shanghai, where it exits into the East China Sea. The main shipyards, mostly belonging to the CSSC, located in the region of the Yangtze River Delta are listed in Table 1.

Table 1**. Main shipyards in the Yangtze River area**

Name of shipyard	Province	Company	Build/Repair
Waigaoqioa	Shanghai	CSSC	B
Hudong-Zhonghua	Shanghai	CSSC	B
Chengxi Shipyard	Jiangsu	CSSC	B/R
Shanghai Shipyard	Shanghai	CSSC	B/R
Jiangnan Changxing	Shanghai	CSSC	B
Huarun-Dadong Shipyard	Shanghai	CSSC	R
NACKS	Jiangsu	JV COSCO&KHI	B
New Century	Jiangsu	Private Enterprise	B
Yangzijiang	Jiangsu	Yangzijiang Shipbuilding (Holding)	B
New Yangzi	Jiangsu	Yangzijiang Shipbuilding (Holding)	B
Dayang	Jiangsu	Evgreen Group	B
LiXin Shipyard	Shanghai	CIC	R
Kouan Shipyard	Jiangsu	China Commerce	B/R
Jinling Shipyard	Jiangsu	CNSC	B
Wuhu Shipyard	Anhui	CSSC	B
Jiangdong	Jiangsu	CNSC	B
Yicang Shipyard	Hubei	CNSC	B
Qingshan	Hubei	CNSC	B

Source: China Shipbuilding Economy Research Center.

China also has an extensive coastline along its eastern and southern extremities. Being very close to dense shipping routes, and with numerous sea and river ports along the coast, these have brought trade to the region for centuries. Encompassing the areas to the south of Shanghai down to the Pearl River, the region includes Zhejiang, Fujian, Hainan provinces and Hong Kong. The main shipyards in the region are shown in Table 2.

Table 2. **Main shipyards of the East and South China coasts**

Name of shipyard	Province	Company	Build/Repair
Zhejiang Shipyard	Zhejiang	Evgreen Group	B
Zhoushan wuzhou	Zhejiang	Zhejiang Shipping	B/R
Hongguan	Zhejiang	Municipality	B/R
Haifeng	Zhejiang	Municipality	B/R
Jianghai	Zhejiang	Municipality	B
Cosco-shipyard (Zhoushan)	Zhejiang	Cosco-shipyard	B/R
Xiamen	Fujian	Fujian SIGC	B
Mawei	Fujian	Fujian SIGC	B/R
Yangfan	Zhejiang	Jianlong Steel	B/R

Source: China Shipbuilding Economy Research Center.

The Pearl River is the largest river in South China. Like the Yangtze, the Pearl River has fostered a number of shipbuilding facilities near its mouth, primarily around the Guangdong, Guangxi, Guizhou and Yunnan provinces. Table 3 identifies the main shipyards of the regions along the Pearl River.

Table 3. **Main shipyards of the Pearl River area**

Name of Shipyard	Province	Company	Build/Repair
Guangzhou International	Guangdong	CSSC	B
Wenchong	Guangdong	CSSC	B
Wenchong-Yuanhang	Guangdong	CSSC	R
Cosco-shipyard (Guangzhou)	Guangdong	Cosco-shipyard	B/R
Yiu Lian - Shekou	Guangdong	Yiu Lian	R
BoLuoMiao Shipyard	Guangdong	CIC	R

Source: China Shipbuilding Economy Research Center.

Another cluster of shipbuilding facilities is located in the area extending from the Yellow River (China's second longest river) to the Heilong River in northern China, which forms most of the north-eastern boundary with Russia. Primary shipyards in the region are listed in Table 4.

Table 4. **Main shipyards of the Yellow River, Heilong River and North China Coast area**

Name of shipyard	Province	Company	Build/Repair
Dalian	Liaoning	CSIC	B
Bohai	Liaoning	CSIC	B/R
Qingdao Beihai	Shandong	CSIC	B/R
Shanhaiguan	Hebei	CSIC	B/R
Xingang Shipyard	Tianjin	CSIC	B/R
CSG –Dalian	Liaoning	CSG	B/R
Cosco-shipyard (Dalian)	Liaoning	Cosco-shipyard	B/R
Yantai Raffles	Shandong	Yantai Raffles and JV	B
Weihai	Shandong	Province	B
Huanghai	Shandong	Province	B
Qingdao-Hyundai	Shandong	JV	B

Source: China Shipbuilding Economy Research Center.

The China State Shipbuilding Corporation (CSSC) owns shipyards principally around the Yangtze River near Shanghai, including the Guangzhou, Chengxi, Wuhu, Jiangnan, Hudong, Hudong-Zhonghua and Qiuxin shipyards. The China Shipbuilding Industry Corporation (CSIC) is principally located around the Gulf of Bo-hai (Dalian), consisting of the Bohai, Dalian, Dalian New and Wuchang shipyards. The main independent yards comprise the Xingang, Welhai, Jiangdu, Nantong, Jinling, Jiangdong, Shanghai Edward, Waigaogiao Mawei, Xiamen, Guang. Wenchong, Zhejiang, Qingshan, Kouan, Jiangsu and New Century shipyards.

The role of shipbuilding in the Chinese economy

Since 1980 China has experienced considerable economic growth, with the gross domestic product (GDP) growing at an annual average of 9.7% from 1978 to 2006 and at 11.4% in 2007. China's accession to the World Trade Organization (WTO) in 2001 was crucial in promoting China's integration into the global trade system, which has helped it to sustain economic growth, increase domestic purchasing power and become the world's leading exporter.

The Chinese shipbuilding industry experienced considerable expansion in parallel with China's accelerated economic growth. This economic development, driven by

exports, has relied heavily on seaborne transport services, but unlike other emerging economies which relied heavily on foreign shipping services, China adopted a policy of building up its domestic fleet to meet the growing demands of international trade, and this greatly increased the commercial output of new vessels. While Chinese shipyards delivered only 0.9% of all vessels in 1985, that proportion had increased to 4.7% in 2000 (on a dwt basis). During the period between 2000 and 2005, the yearly output of the Chinese shipbuilding industry outperformed the EU-25, and firmly entrenched its position as one of the top three players in the global market. (Ludwig and Tholen, 2006).

The statistics compiled by the Commission of Science, Technology and Industry for National Defence (COSTIND) show that in 2005 there were more than 2000 shipbuilding companies in China, which employed a workforce of around 400 000, of which 315 000 were employed by the 480 largest companies (COSTIND, 2005).

Status as a strategic industry

The shipbuilding industry is technology, labour and capital intensive. 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. In 2006 the Chinese government unveiled an official shipbuilding blueprint to guide the medium-and long-term development of the shipbuilding industry. This National Medium- and Long-term Plan focuses on systematic planning to identify and remove barriers to industrial development. The Plan urges the Chinese industry to increase its efforts over the next five to ten years in order to challenge existing mainstream shipbuilders.

China is particularly well positioned to develop this industry compared to most economies, as it has a number of significant advantages with respect to the primary inputs into this industry sector. These include the availability of land, a large, well-trained and relatively cheap labour force and complementary industrial support from other sectors such as the iron and steel, metallurgical and machinery manufacturing industries. The shipbuilding sector also has access to capital investment to strengthen and upgrade technical and technological capability, which has enhanced its design and construction capability to allow the competitive construction of VLCCs, environment friendly bulk carriers and technically advanced container ships. China is now also capable of constructing sophisticated, large scale LNG carriers.

Relationship with other industry sectors

In pursuit of China's stated aim of becoming a major shipbuilder, COSTIND has identified the marine equipment industry as a key element in the supporting industrial infrastructure, and has accorded it a very high priority. For example, marine electronics, as a by-product of developments in the shipbuilding and information industries, is emerging as a new growth area in the national economy. The 11th National 5 Year Economic Plan (2006-10) provides for China to increase its local supply capability and the technological level of marine equipment, in order to optimise the industrial chain supporting the shipbuilding sector.[5]

In many developed economies, shipbuilding is frequently closely related to the iron and steel industries. For instance, America's General Dynamics Marine Systems covers the two industries. The Korean steelmaker POSCO invested in the Korean Daewoo shipyards to ensure a closer integration of those activities, and Japan's JFE Steel

Corporation has also acquired a world-class shipbuilding enterprise. The recent increases in the price of steel have increased the cost of shipbuilding, and as a result some shipyards have found it difficult to generate profit from orders based on contracts signed before the steel price rose. From the perspective of steelmakers, the integration with shipbuilding enterprises would provide a steady and relatively predictable demand for their products. In China, many iron and steel enterprises have expressed their willingness to build up manufacturing, processing and distribution centres with shipbuilding enterprises in order to improve production efficiency and decrease production costs.

Policies of the Chinese government

Governments at different stages of economic development view shipbuilding as a strategic industry, which not only creates economic benefits but also helps deliver public policy outcomes. The impacts of industrial development could include generating employment, accelerating regional development, increasing industrial and defence capacity, and strengthening technological capability. It can also act as a catalyst to attract direct and indirect foreign investment (OECD, 2007).

The rapid growth of Chinese shipbuilding is also closely linked to the government's macroeconomic policies. Through its "five year plans", the Chinese government frames its guidelines for the development of different sectors to ensure their long term sustainability and competitiveness. The 11th National 5-year Economic Plan was the first to specifically mention the maritime sector.

As part of this plan, the National Development and Reform Commission (NDRC) and the Commission of Science, Technology and Industry for National Defence (COSTIND) have formulated a mid- to long-term programme for the development of the shipbuilding industry, which was approved by the State Council. The key targets set by the Plan include encouraging foreign investment and Sino-foreign joint ventures, opening the sector for public investment, increasing annual output to 17 million dwt by 2010, increasing the output of locally produced ship equipment by more than 60% by 2010, speeding up the construction of key shipbuilding facilities[6] and increasing annual production capacity of medium and low speed ship diesel engines to reach 4 million kw and 1 100 units respectively.

The role of government

The NDRC generally takes charge of China's industrial planning. For its part, the COSTIND,[7] situated under the State Council, is responsible for introducing policies, implementing industrial development, enacting laws, regulations and standards, supervising enterprise operations and providing co-ordination and services among defence related industries. While the COSTIND does not become involved in the general business operations of individual companies, in order to create a workable business environment it does undertake a number of measures to prevent over-investment, and follows normal market mechanisms to keep the market in order.

The Ship Management Office, an independent unit under the COSTIND (before the recent decision on Chinese government's restructuring projects made at the 11th National People's Congress), is responsible for the formulation of industrial and technological policies and plans for military and commercial ships. The Office, collaborating with

26 province level offices, compiles statistics, releases annual reports and calculates the production output and manufacturing capacity of the shipbuilding industry.

In accordance with the 11th national 5-year Economic Plan, the COSTIND is implementing plans to strengthen and upgrade the overall shipbuilding industrial capability through the construction of three major modern shipyards. It is also upgrading existing shipbuilding facilities, encouraging industrial consolidation and promoting new private or joint-venture shipyards. The Plan also focuses on the requirement for advances in new ship design, and investment in quality management, resource and supply structures.

According to the China Shipbuilding Economy Research Center,[8] in order to regulate the development of the Chinese shipbuilding industry, the Chinese government is formulating Provisions on the Administration of Shipbuilding License. The major goal of these provisions is to establish a market access system for shipbuilding, clarify legal conditions and standards, prevent unqualified and incapable enterprises from entering the shipbuilding market, enhance macro-control over the development of the shipbuilding industry, promote the overall level of the shipbuilding industry, control the hidden accidents of ships from their origin and ensure the transportation safety of ships and the safety of the lives and properties of people.

Support given to industry

The Chinese government generally supports the shipbuilding industry by exempting it from tariffs applicable to imports for key components necessary for the production of some kinds of high-tech ships, and by providing incentives for investment in R&D and innovation. The tariff policy is also closely related to the Chinese government's endeavours to balance foreign exchange income and expenditure.[9] The principal measures, aimed at increasing competitiveness in the industry, include promoting industrial consolidation and reconstruction, establishing international R&D and technical co-operation, improving management skills and risk control, and providing financial assistance.

The Chinese government contributed to a survey conducted by the Council Working Party on Shipbuilding in late 2007 to construct an inventory of subsidies and other support measures provided to the shipbuilding industry. The response by China indicated that, in general, the Chinese government supports include export credits, support for research and development and protection of the domestic market. The Export-Import Bank of China is responsible for providing export credits to borrowers of up to 80% of the value of commercial contracts. The maximum maturity period is 15 years and the interest rate can either be fixed or floating, plus an unspecified interest rate spread.

In its support for research and development to industries, the COSTIND has since 2001 selected basic, general-purpose and frontier technologies as major targets. Between 2004 and 2006, the research and development supports amounted to 10 million yuan, or around USD 1.21 million. In the protection of the domestic market, the State Oceanic Administration purchases domestically built ships when these are cost-effective. A further protection to the domestic market is provided through the application of tariffs on imported ships by the Ministry of Finance. These tariffs, which are in accordance with the commitments to the Protocol on the Accession of the Peoples' Republic of China to the WTO and customs agreements between China and other economic entities, range from 3% to 10.5% depending on the type of vessel (OECD, 2007b).

Under the guidelines applicable to the National Economic Plan, the Chinese government can introduce various financial supports intended to assist its shipbuilders to compete in world markets, thus enhancing the likelihood of China achieving its stated medium to long term objective of becoming one of the largest and strongest shipbuilders in the world. Those measures include (Ludwig and Tholen, 2006):

- *Export tax rebates*: Chinese shipyards can claim export tax rebates for the construction of vessels for export. According to an explanation from the China Shipbuilding Economy Research Center, the purpose of the export tax rebates is to avoid repeated collection of tax, and is in line with international practice and WTO rulings.
- Investment funding reforms: Shipbuilding companies are allowed to raise capital for plant and site development from public issues or corporate bond sales.
- Stabilisation of material costs: To secure a steady flow of steel supplies for the shipbuilding industry, the government plans to deliver up to 80% of the required steel through domestic steel producers. In order to reach this target of supplying high-end materials domestically, the government has introduced measures to support technological innovation and development of the steel companies.
- Involvement of foreign partners: The government's plan is aimed at increasing the local production of key components used in shipbuilding. Therefore it has allowed Chinese maritime suppliers to create joint-ventures with foreign partners, and has also allowed foreign maritime suppliers to build up their own production plants in China. However, foreign investors in new shipbuilding and marine engine manufacturing units are only allowed to own up to 49% of those ventures, with the Chinese partners retaining a majority (and therefore controlling) interest. Such ventures must also provide shipbuilding technology support by establishing their own R&D units.

Since the 1980s, in order to encourage foreign investment, the Chinese government has established several Special Economic Zones in which foreign investors receive preferential tax, tariff, and investment treatment. In terms of shipbuilding and ship repairing, these investments have largely taken the form of joint-venture operations between the state or domestic investors, and foreign investors.

Financing and guarantee schemes

To speed up the process of privatisation in the shipbuilding industry, and in recognition of the capital intensive character of the industry and its long term investment profile, the Chinese government overhauled the conventional financing and investment system by playing a role to strengthen structural flexibility and providing assistance to facilitate the acquisition of capital. This was achieved principally by encouraging state-owned and private banking institutions to provide financial support to shipbuilders.

The Chinese banking sector has traditionally been considered by authorities as a substitute for state financing to ensure a continued flow of funding to its state-owned enterprises, including those involved in shipbuilding. Finance for the shipbuilding sector can be broken down into two general areas: *i)* shipyard finance for capital acquisitions, and *ii)* capital to finance each shipbuilding project. Each can be of critical importance to the well being of the shipyard, because without a source of funds for capital acquisitions,

the shipyards would be unable to modernise and would lack the equipment and tooling required to build ships competitively.

China Eximbank aims to create a network of links with the shipping industry and its ancillary government sectors. It has created new ground for Chinese shipbuilding as the economy's only export oriented bank that could make Chinese yards even more competitive, as well as offering attractive packages for ownership buyers. In a special report prepared by the China Daily in May 2005,[10] China Eximbank had provided different types of financial support, such as direct lending and guarantees, for over 90% of Chinese ship exports, and has become the major channel for Chinese ship financing.

The bank plays an important role in helping Chinese shipbuilding enterprises compete with their international counterparts, and in accelerating the development of China's shipbuilding industry. Until recently, nearly all the domestic large- and medium-sized shipbuilding enterprises, including China State Shipbuilding Corporation (CSSC) were the Bank's key customers, and by the end of 2003, China Eximbank had financed the export of 976 ships totalling 25 million dwt, with loans totalling 65.5 billion yuan. More recently, as well as the Eximbank, other major Chinese banks, such as the China Construction Bank, the Bank of China, the Agricultural Bank of China and the Industrial and Commercial Bank of China, have also become involved in transportation and infrastructure finance.

R&D and innovation

China has sought to improve its shipbuilding technologies, and some of the ship models, designed and made entirely in China, have entered the world mainstream markets. According to figures compiled by China Association of the National Shipbuilding Industry (CANSI), in 2005, a 170 000-ton bulk carrier model designed and made by China received 18 orders, accounting for 45% of the total sales of such ship types in the world. A 300 000 ton ultra-large crude oil carrier made by China has captured 20% of the world market for such vessels. In addition, China has successfully developed an 8 000 teu container vessel and is understood to be able to manufacture container vessels up to 10 000 teu. The first, large Chinese built LNG vessel was successfully delivered in April 2008.[11]

In order to accelerate its technical capability, China has been importing advanced production methods and key equipment including complete production lines, as well as using foreign sourced hardware and software for computer-aided design and computer-aided manufacturing (CAD/CAM). This has enabled Chinese naval architects to become more proficient in the design of ship hulls, compartment layouts, and propeller-rudder combinations that improve speed, efficiency, and structural integrity. Joint ventures between Chinese shipbuilding enterprises and established Japanese and Korean yards are transferring technology, engineering skills and production know-how to China.

The structure of the industry

Prior to May 1982, China's shipyards, associated institutes and factories were organised under the Sixth Ministry of Machine/Building Industry, the Ministry of Communications, and the State Administration of Aquatic Products. The Ministry of Defence also made inputs into the design and construction of all types of naval vessels.

Provinces, municipalities, and autonomous regions also were permitted to operate shipyards.

More specifically, the construction of larger merchant ships of various types, specialised vessels to serve the oil industry's exploration and development, as well as naval vessels were under the jurisdiction of the Sixth Ministry of Machine Building Industry's umbrella body, the China Corporation of Shipbuilding Industries (CCSI). Some smaller merchant ships, inland waterway vessels, and ship repairs for coastal ships were the province of the Ministry of Communications. Fishing vessels and their repair came under the supervision of the State Administration of Aquatic Products.

In keeping with reforms to simplify and restructure management and reduce China's bureaucracy, a number of ministries, state corporations and commissions were merged or eliminated in the years that followed. At the same time, the Ministry's China Corporation of Shipbuilding Industry was merged with the shipbuilding and ship repair functions of the Ministry of Communications to form the new, more unified China State Shipbuilding Corporation (CSSC), which as a state corporation had ministry status under the direct authority of the State Council.

In 1994, the CSSC was operating 27 shipyards, 56 equipment manufacturing plants, and had an annual vessel production capacity of 1.5 million dwt. While the Ministry of Communications retained the right to import ships, virtually all other shipbuilding functions except certain ship repairing were transferred to the CSSC. The most obvious effect of this change was that it grouped various shipyards and factories into units, which were formed by taking shipyards and factories that had belonged to other ministries. The CSSC was also charged with the setting of long-term development plans for the shipbuilding industry, deciding strategies, building new facilities, introducing new technologies and establishing subsidiaries abroad. While the Chinese government remained a major stakeholder, the structure of CSSC's operation was altered to reflect a more enterprise style of operation, including taking responsibility for its business performance.

At the same time, some Chinese shipbuilding enterprises have entered the capital market; for example Yangzijian Shipbuilding (Holdings Ltd) of Jiangsu Province recently successfully listed on the Singapore Stock Exchange.

Analysis of the structure of the Chinese shipbuilding industry

In 1999, the state owned shipbuilding industry was split into two groups; one remained the China State Shipbuilding Corporation (CSSC) while the other became the China Shipbuilding Industry Corporation (CSIC). The CSSC and CSIC are both large, state-owned enterprises under the direct supervision of the State Council.

The CSIC became one of the major shipbuilding and ship repairing service providers in China, consisting of affiliated enterprises mostly located around Dalian in northern China (in the region of the Gulf of Bo-hai), and employs a workforce of over 170 000. It produces around 1 million dwt shipbuilding output per annum. The CSIC possesses design, scientific and technological research institutes, and engages in the trade of both military and commercial ships, marine engineering and marine equipment. In 2000, the CSIC Dalian Shipyard received an order to build five 300 000 dwt VLCCs which set a record in total value and tonnage for a single order.

The China State shipbuilding Corporation (CSSC) retained the balance of facilities and activities and remained as a large conglomerate and state authorised investment institution, directly administered by the Chinese central government. It is regarded as the mainstay of the shipbuilding industry in China, and there are 60 sole proprietorship enterprises and shareholding institutions under its umbrella, including some of the most renowned shipbuilding and ship repairing yards, research and design institutes, marine-related equipment manufacturers and trading firms in China.

In the field of commercial ships, the CSSC has the capacity to build most types of modern vessels, and can produce a wide spectrum of products, ranging from conventional oil tankers and bulk carriers through to vessels such as LNG carriers, VLCCs, chemical carriers, ro/ro passenger freight ships and offshore facilities. The CSSC's shipyards are principally located around the east coast of the Yangtze River delta and southern regions of China.

Changjiang National Shipping Corp (CNSC) is one of the main domestic shipping companies in China. It operates, directly and through various regional subsidiaries, on the Yangtze River. CNSC and its subsidiaries own four major shipyards – Jiangdong, Jinling, Qingshan and Yichang – and around 20 smaller yards.

Another major grouping is the COSCO Shipyard Group, which is a subsidiary of the China Ocean Shipping Company, the largest of the state-owned shipping operators. The COSCO Shipyard Group owns four shipyards, three of which operate predominantly in the repair and conversion sector and one of which is a new-building yard. Three of the COSCO yards are operated as joint ventures with international partners; the Nantong shipyards – NOSEC and NACKS – are both joint ventures with Kawasaki Heavy Industry (KHI) of Japan and the Dalian yard is a joint venture with Sembcorp of Singapore.

The China Shipping Industry Company (CIC), established in 1998, is a subsidiary of the China Shipping Group, which is itself the second largest of the state-owned shipping companies. The CIC owns six yards, which are predominantly involved in the repair and conversion sector rather than shipbuilding, although ChengAnWei yard does have shipbuilding capability and DiGang offers new-building and ship scrapping services as well. Three of the yards are located in Shanghai, two in Guangzhou (Guangdong province) and the other in Anhui.

The Fujian Shipbuilding Industry Group is owned by Fujian province, and comprises four shipyards. The Mawei and Xiamen yards are the two largest facilities and are predominantly new-building yards. The other yards, Southeast Shipyard and Shanyou Marine Steel Structure yard, are smaller and have been involved in both the new-build and the repair sectors.

Finally, YiuLian Dockyards is a Hong Kong-based group which owns three shipyards located at Hong Kong (China), Shekou and Zhangzhou. These yards are predominantly involved in repair work.

Ownership structure, joint ventures, foreign participation

The general Guidelines on Foreign Investment provide the basis on which foreign investment proposals are judged (including in the shipbuilding sector), in particular with respect to the resulting industrial competitiveness and environmental protection. In general terms, proposals for foreign participation are classified under one of four categories (general terminology only):

- Stimulation (may be eligible for special conditions or assistance);
- Permitted;
- Permitted with restrictions;
- Prohibited.

The four most common types of co-operation between Chinese and foreign companies are joint ventures, partnerships, Chinese owned companies (with at 51% Chinese ownership) and Chinese holding companies (with Chinese investors being the largest, even if not majority, stake holders).

The national medium and long term plan for the shipbuilding industry provides that foreign shipbuilders are allowed to reorganise, acquire or jointly fund shipbuilding enterprises provided they hold no more than 49% of the shares. The same rules apply to enterprises engaged in the production of ship components, including new ventures such as those to produce medium- and low-speed ship diesel engines and crankshaft manufacturing enterprises.

Further, in order to foster advanced technology and management skills and to promote foreign involvement in the sector to ensure sustained development, the government also requires Sino-foreign joint ventures to set up technical centres to absorb and disseminate technologies transferred by foreign investors. Such joint ventures have provided China with an operational capability that may not have otherwise existed, and also provided a short-cut way to close the gap between China and the established market, both in terms of technology and structure. A number of joint ventures have been established in recent years, particularly with established Japanese and Korean yards, to facilitate the transfer of technology, engineering skills and production know-how to China.

Rationalisation/changes to the distribution of yards

Ever since China adopted its policies of reforming and opening its economy, it has laid a foundation in capital, skills, technology and infrastructure for its shipbuilding industry. In particular it has exploited its skilled and relatively low-cost labour force, which is one of China's most important natural advantages. The entry of large, foreign shipbuilding enterprises reflects this opening of the market and has resulted in a significant expansion of production capability, which in turn has strengthened the competitiveness of the Chinese shipbuilding industry. MOFCOM (Ministry of Commerce of the People's Republic of China) statistics show that in 2005, among the national programmes proposed for foreign co-operation and investment, the shipbuilding industry filed 104 separate proposals, with contract value of around 1 369 million yuan.

While at present there are few wholly owned foreign enterprises in China's shipbuilding or marine equipment industry, this situation is gradually changing. For example, in recent years Korean investments have included Daeyang Shipping Co. and Oriental Precision & Engineering Co. in Dalian; the Samsung Group in Ningbo; Daewoo Shipbuilding at Bajiao port in Yantai and Doosan Engine and STX Engine in Dalian (MOFCOM and China's related ship Associations, 2005). Foreign capital from Europe, Korea, the U.S. and Japan has also been invested in enterprises engaged in support activities, such as diesel parts, propellers, deck machinery, cabin and outfitting equipment, marine automation systems, marine electronic products and coatings and

cables. Foreign enterprises investing in the marine equipment manufacturing industry include Wartsila, ABB and Catepillar.[12]

Workforce (including training and education)

China's principal advantage on the world market has always been the price of its vessels, which is largely a function of generally lower production costs, in particular its abundant supply of skilled, low cost labour. The low cost of labour is particularly important as wage costs represent roughly one third of the overall cost of constructing a vessel. However, since the 1990s, the average production costs in China have escalated, in part due to the surging prices of production materials, but more importantly from the perspective of Chinese competitiveness, because of the increasing cost of labour without commensurate improvements in productivity, which is low by international standards. According to a report by COSTIND,[13] the average production output in Japan and South Korea is around 10-15 times more than that in China, and furthermore Japan's and South Korea's average output value is 20 times higher than in China. A more recent appraisal by the China Shipbuilding Economy Research Center[14] suggests that production efficiency has been increasing rapidly, and that at present the per capita output and per capita production values are about 1/6-1/4 of those of Japan and Korea.

This lower productivity is apparently offsetting the competitiveness of the Chinese yards in the world market, and is threatening China's ambition to become the major shipbuilder economy in the world. Under the 11th national 5-year Economic Plan, China is aiming to improve the productivity of the industry by introducing measures such as training of the workforce, renovation and modernisation of equipment in State-owned shipbuilding enterprises, and the attraction of foreign technology and capital. The Chinese government's objective is to narrow its productivity gaps with Japan and South Korea from one-sixth currently to between one-fourth and one-third by 2010.

Construction/production capabilities

The strength of the Chinese shipbuilding industry has been its ability to build competitively priced basic vessels, especially bulk tankers. While its shipbuilding industry is increasingly diversifying into more complex and technologically advanced vessels, this heavy reliance on bulk vessels remains. While there was a strong increase in orders for tankers in 2006 (the crude oil/oil product tanker orderbook increased from 196 to 348 in that year) this appeared to be a temporary rise, and new orders for tankers stalled in 2007. Significantly, the 2007 figures showed that the 1201 bulk/ore carriers on order totalled 52.43 million gt, accounting for 54% of the overall orderbook, while tankers of various kinds accounted for around 21% (Lloyd's Register Fairplay, 2005, 2006, 2007). In its published figures for 2006 COSTIND also noted that Chinese shipbuilders were committed to building 55 VLCCs which was about one third of the global demand. In addition, the orderbook included 53 Capesize bulk carriers (170 000 dwt) which accounted for around 45% of world total (COSTIND, 2007).

However, also significantly, the 2007 orderbook highlighted the increasing diversification of the Chinese shipbuilding industry, as it also contained significant orders for a broad range of more complex and technologically advanced vessels, such as vehicle carriers (51), LNG/LPG carriers (26) and 496 container ships (Lloyd's Register-Fairplay, 2007). Therefore, while it is still fair to characterise the Chinese shipbuilding industry as heavily dependent on the bulk carrier market, it should also be recognised that it is

rapidly diversifying, and it is likely that this diversification will enable it to increasingly compete on the international export market for a wide range of different vessel types.

Access to and development of technology

The CSSC has expressed its intention to ramp up production in the hi-tech sector of the market, including LNG carriers and vessels that support the offshore oil and gas industry, such as floating production, storage and offloading units (FPSOs). The CSSC's wholly owned subsidiary Hudong-Zhonghua Shipbuilding is currently China's only builder of LNG vessels.

According news released in September 2007,[15] Lloyd's Register (LR), currently operating 11 offices in China with regional headquarters in Shanghai, committed several million yuan in 2007, developing a series of training and educational courses and related infrastructure in China. The Lloyd's Register Maritime Institute in shanghai was designed to provide a centre of learning from where working surveyors and auditors can share their technical knowledge with China's shipbuilders, owners and maritime experts, and support design and related research and development based on industrial greatest demand. Those efforts will effectively strengthen design and R&D competitiveness in volume ship types, such as tankers, bulk carriers and container vessels.

The role of shipbuilding associations

China has a number of trade associations, research and design institutes and societies related to the shipbuilding industry. Their roles are to provide technical consultancy services and advice, as well as to provide a forum for industry news, comments, analysis and developments. Some of the institutions represented are as follows:

- *China Association of the National Shipbuilding Industry (CANSI)*: This is a national, non-profit organisation of the shipbuilding trade that was established to provide a bridge between Government departments and its industry members. The CANSI is the most significant organisation in the shipbuilding industry, with its members accounting for 90% of national production. Its members consist of shipbuilders, ship repair contractors, marine engine manufacturers, marine instrument manufacturers and other marine equipment producers, ship designers, surveyors and inspectors.
- *China Classification Society (CCS):* The CCS is a technical organisation providing classification and statutory surveys of ships, offshore installations, containers and other related equipment and materials, as well as providing technical consultancy services. The CCS is a member of the International Association of Classification Societies (IACS) and has established 39 branch offices in China and 20 branches among 14 countries and regions. The CCS is the only specialised body in China that carries out international standard classification surveys of ships.
- *The China Classification Society Industrial Corporation (CCSI):* This is a CCS subsidiary engaged in the supervision and inspection of engineering equipment, enterprise management consulting, technological development, machinery equipment repairing, non-destructive testing service, personnel training and technical consulting service. The CCSI has established subsidiaries in the

majority of domestic coastal cities, and runs joint ventures on insurance and risk management respectively with British Thomas Miller and American ABS.

- *China Shipbuilding Engineering Association:* This Association, established in 1943, is a non-profit organization with a membership of more than 30 000 national professionals from research institutions, academies and industry. The Association aims to promote the development of the shipbuilding industry by exchanging knowledge and promoting advanced technology and consultancy services.
- *Technology Research and Economy Development Institute:* This Institute, situated under the umbrella of CSSC, is a research institution providing services to the national shipbuilding industry. Its business scope includes information collection and analysis, consultancy services on ship standards and specifications, and marine products licensing.

The role of minor yards and repair/ship conversion capability

China has a large number of small yards predominantly located along its main river systems, many of which build or repair small vessels, such as passenger/leisure craft, barges, river boats, harbour craft and fishing vessels, for local use. Tugs and fishing vessels are important sectors for small Chinese yards, and while most of these vessels are likely to be for domestic clients, some vessels are produced for export. One emerging sector in which smaller Chinese yards are becoming active is the offshore support vessel sector, which serves the growing offshore activities of China. In addition, there are several less well known yards, building high speed craft which serve the needs of the domestic market for local and inter-provincial transportation. There is also a fledgling luxury boat sector.

China also possesses many yards that are primarily dedicated to ship repair, most of which are small and totally dedicated to meeting local needs. However, over the last few years, ship repair and conversion has gradually became a mainstream business due to the fact that low labour costs and the plentiful availability of capacity at these small and medium shipyards have attracted the attention of large local and foreign contractors. For international operators, these yards could undercut competitors (such as Singapore) in repair work by as much as 30%, and would therefore be attractive economic propositions.

Ship repairing in China is concentrated in the areas of Shanghai, Guangzhou and the Gulf of Bohai. The market is mainly shared by China Shipping Industry Company (CIC), China Ocean Shipping (COSCO) and other smaller yards. COSTIND's report of March 2007 showed that the trend in ship repair and conversion activities was gradually moving toward large scale and technology intensive activities. In 2006, China undertook repair work on bulk carriers involving vessels totalling 365 000 tons and completed 59 vessel conversions that included double-deck oil tankers and RoRos. Importantly, reported profits generated by ship conversion activities totalled 240 million yuan in 2006, a sharp increase from past years (COSTIND, 2007).

Under the consideration of using constrained capacity to maximise overall profits, the trend is becoming more apparent that many ship repairers are switching their core business from ship repairing to ship conversion. For instance in 2007, COSCO the largest repair company in the country, allocated half of its work force to conversion which contributed almost 80% of its yearly earnings. Moreover, reflecting the upswing of production materials and domestic labour costs, China's ship repairers announced they

would raise prices in stages by a total of as much as 30% in 2008, to bring prices more in line with repair yards elsewhere in Asia (Jim James, 2008).

The role of the marine equipment industry

COSTIND's report, published in March 2007, noted with concern that the Chinese shipbuilding industry was facing challenges due not only to the appreciation of the Chinese yuan, but also because of shortcomings in the marine equipment industry, which was unable to keep pace with the rapid growth of the shipbuilding sector (COSTIND, 2007).

In China, about 50–60% of the equipment and components for the shipbuilding industry are imported from other countries, and this dependence on imports – especially high-end technology and key equipment and components – not only reduces profit margins, but also hinders China's efforts to develop a fully integrated shipbuilding sector. The development of the marine equipment industry to underpin the growth of the shipbuilding sector overall has been identified as a key objective, and an objective of the current Economic Plan is that 60% of the parts used on China-made ships should be domestically produced, up from 46% in 2006.

Principal Construction Facilities

Design capabilities

With respect to commercial shipping, the CSSC and CSIC are capable of designing and building modern ships complying with international rules and requirements. In addition to the in-house design centers established by the CSIC and CSSC, there are a number of independent research and design centers located nationwide to provide ship design services. These centers include:

- China Ship Design and Research Centre Co., Ltd. has established a platform to provide engineering and design services to ship and rig building companies.
- China Shipbuilding Industry Institute of Engineering Investigation and Design (CSEI): This holds qualification for engineering surveying, supervision and consultation of ship design projects.
- Jiujiang Precision Measuring Technology Research Institute: This is the research institute of China State Shipbuilding and is especially engaged in researching precision measuring, processing and metering technology.
- Marine Design and Research Institute of China (MARIC): This operates a marine design and research institute in China and is also the national engineering research centre for ship design.
- Changjiang Ship design Institute: This is the largest ship design and research institute in the transportation area.
- Guangzhou Marine Engineering Corporation (GUMECO): Under the leadership of CSSC, GUMECO functions as an engineering design and scientific research organisation in the South China region, and specialises in areas such as offshore

engineering, ship design, electromechanical products, steel structure engineering and advisory services.

- China Ship Research & Design Center: This state-owned enterprise is the research institute of the China Shipbuilding Heavy Industry Corporation. Its services cover the field of national defense, taking charge of China's ship design, research and development.
- Shipbuilding Technology Research Institute (STRI): STRI, attached to CSSC, is a research and development organisation concerned with shipbuilding technology.
- The Ninth Design and Research Institute: Its functions focus mainly in the design and research areas of hydraulic and special engineering.
- Shanghai Merchant Ship Design and Research Institute: This is capable of designing cargo vessels, offshore and military support vessels and harbor workboats.

Industry performance

Generally speaking, in parallel with the shipbuilding industries in other parts of the world, China has benefited from the very strong international shipbuilding market. In 2006, the total production output value for major producers in the shipbuilding sector totaled 172.2 billion yuan, a 37% increase over the previous year. With respect to its completions for that year, COSTIND data show that bulk carriers constituted the largest single ship type, accounting for 45% of total output (a slight reduction on the previous year), followed by oil tankers at 33% and container ships at 14%.

Output and world share of production

According to figures published in China, its shipbuilding industry developed rapidly during the period of the 10th National 5-Year Economic Plan (2000-2005), with an average annual growth rate of 29%. COSTIND's statistics also indicated that over the period 2002-2005, China boosted its shipbuilding output by more than 40% a year. In 2006 Chinese shipbuilding output reached 14.5 million dwt, accounting for 19% of the global market. This proportion is slightly higher than the Lloyd's Registry-Fairplay figures for the year (14.8%) derived on the basis of completions expressed in gt (as opposed to dwt) COSTIND also estimated that in 2006 China's new orders reached 42.5 million dwt, a 30% share of the global market (which would make it one of the fastest growing industries) while the overall orderbook reached 68.72 million dwt, or 24% of the global market (COSTIND, 2006; COSTIND 2007).

On the basis of internationally published information on shipbuilding production, in 2007 China remained the third largest producer of commercial vessels, behind Korea and Japan (see Table 5).

Table 5. **World shipbuilding production, 2007**

Location of build	Number of vessels	Output in m.GT	Percentage
Korea	425	20.20	35.68%
Japan	539	17.31	30.58%
China	643	10.41	18.39%
Germany	69	1.34	2.36%
Italy	25	0.70	1.23%
Denmark	4	0.85	1.50%
Croatia	25	0.69	1.21%
Chinese Taipei	16	0.66	1.16%
Poland	44	0.56	0.98%
Turkey	109	0.53	0.93%
Romania	43	0.43	0.75%
Philippines	10	0.36	0.63%
Rest of world	737	2.4	4.24%
Total	2,689	56.6	

Source: Lloyd's Register-Fairplay (2007), *World Shipbuilding Statistics*, December.

On this basis, in 2007 there was a significant gap in production between China and its principal competitors, but the true state of its world rank may be better judged by examining orderbooks rather than production.

Analysis of orderbooks

At the end of 2007, the shipbuilding orderbook was dominated by South Korea (Table 6) which had captured 126.5 million gt, equal to 38.37% of the total world orderbook. However, the Chinese shipbuilding industry's share of the orderbook also surged, and at that time had overtaken Japan by a clear margin (29.65% compared to 19.35% respectively). While this change in relativity might not be immediately reflected in output data, it appears as if in the course of 2007 China placed itself in a clear position to overtake Japan as the world's second largest producer.

As well as Korea's tightening grip on the orderbook, also of interest is the rapid growth in the orderbooks of a number of emerging economies, particularly the Philippines (which has overtaken Germany), Vietnam and India. If these trends are confirmed by future additions to the orderbook, then this could be the start of a major re-ordering in the structure of the world shipbuilding industry.

Table 6. **Total world new-building orderbook, 2007**

Location of Build	No. of vessels	Million gt	% on gt	Million cgt[1]
South Korea	2,242	126.53	38.37%	63.39
China	3,139	97.76	29.65%	50.22
Japan	1,495	63.81	19.35%	30.71
Philippines	116	5.16	1.56%	2.49
Germany	203	4.17	1.26%	3.78
Vietnam	206	3.20	0.97%	2.14
Romania	146	3.04	0.92%	2.12
Chinese Taipei	67	2.83	0.86%	1.68
India	246	2.61	0.79%	2.03
Italy	118	2.57	0.78%	2.95
Turkey	337	2.35	0.71%	2.34
Poland	122	2.03	0.61%	1.67
Croatia	69	1.99	0.6%	1.20
Denmark	22	1.46	0.44%	0.66
Rest of the World	1,527	10.19	3.09%	10.32
Total	10,055	329.7		177.7

1. CGT – Compensated Gross Tons is a measure developed by a group of major shipbuilder associations in conjunction with the OECD that provides a common yardstick to reflect the relative output of merchant shipbuilding activity in large aggregate. It is widely used by the shipbuilding industry.

Source: Lloyd's Register-Fairplay (2007), *World Shipbuilding Statistics*, December.

Table 7 shows details of the most recent orderbook data for Chinese shipyards by major vessel types. This highlights the significant contribution still being made to the Chinese orderbook by bulk carriers and to a lesser extent by crude oil tankers and container vessels. The very strong contribution by bulk carriers could have a significant impact on the overall orderbook if demand for such vessels were to decline due to the slowing of the world economy. In that case, the true test of the versatility of the Chinese shipbuilding industry will be whether it can attract a sufficient number of orders for other types of vessels to minimise the impact of any slippage in demand.

Table 7. **The orderbook of Chinese yards, 2007**

Type of vessel	No	Million gt	% on gt	Million cgt
Bulk/Ore carriers	1,201	52.431	54.0%	22.555
Crude oil tankers	165	15.611	16.1%	5.268
Container vessels	496	13.075	13.5%	9.020
Oil products tankers	182	4.564	4.7%	2.505
General cargo ships	423	4.363	4.5%	4.034
Chemical/Oil products tankers	219	2.861	3.0%	2.201
Vehicle carriers	51	2.396	2.5%	1.415
LNG/LPG carriers	26	0.673	0.7%	0.659
Remainder	96	0.984	1.0%	1.148
Total	2,859	96.958		48.805

Source: Lloyd's Register-Fairplay (2007), *World Shipbuilding Statistics*, December.

Domestic/export production mix

The boom in China's shipbuilding industry also reflects developments in the shipping industry, which has seen its domestic shipping companies expanding their fleets, driven

in turn by China's rapid economic development and its growing need for foreign energy and mineral resources. However, the most recent significant development has been the serious entry by Chinese shipbuilders into the international shipbuilding market to take advantage of the very buoyant market for new vessels,

After years of producing vessels for domestic customers, the Chinese shipbuilding industry is now actively seeking to expand its international presence, to both exploit the buoyant new-building market, and to utilize rapidly expanding new-building capacity. COSTND's statistics show that exports by Chinese yards reached USD 8.1billion in 2006, an increase of 74% over the previous year, with top destination markets being Germany, Singapore, China (Hong Kong), the Marshall Islands, Malta, Australia, Japan, Panama and the United Kingdom. In particular, exports to Germany and Singapore accounted for 30% of the total export volume in 2006.[16]

The principal types of ships exported included 6 000-and-under TEU container ships, bulk cargo carriers with a carrying capacity up to 150 000 tons and oil tankers up to 100 000 dwt. The State-owned shipbuilders accounted for 78.1% of export sales, Sino-foreign joint ventures 16.8%, and privately owned enterprises 5.1%. According to statistics from Chinese Customs in the first six months of 2007, exports of ship related items reached a record of USD 5.49 billion, a 61% increase compared with the same period of the previous year.[17] Germany and Hong Kong were the top three overseas markets (compiled by COSTIND, 2007).

While ship exports were significant in 2006, more recent COSTIND data, compiled from Customs statistics, indicate that total exports of vessels and related products in the first three quarters of 2007 totalled around USD 8.7 billion, a 62% increase compared to the same period in 2006. Products were shipped to 142 destinations. In the same period, total imports of vessels and related products were USD 940 million.

Financial performance of yards

COSTIND statistics show that China's shipbuilding industry made a record profit in 2006 of 9.6 billion yuan (USD 1.23 billion), from an industry turnover of 172 billion yuan (USD 22 billion). The building of new ships was the most profitable activity, generating profit of 5.3 billion yuan, followed by ship repairing services (2.6 billion yuan) and ship related products and manufacturing of accessories (0.6 billion yuan). The CSSC, which accounted for 40% of China's output, reported profits exceeding 5 billion yuan, and the yard took 100 billion yuan worth of new orders. In the first half of 2007, the total production value amounted to 101.7 billion yuan, an increase of 48% over the same period in 2006 (COSTIND, 2007).

Productivity and competitiveness

Low productivity and comparatively poor management have been identified as the main factors limiting the growth of Chinese shipbuilding. COSTIND's data showed that China, despite ranking third in shipbuilding output over the past 10 years, had an average productivity that was only about one-sixth that of Korea and other major producing economies. However, this productivity disadvantage was offset by China's relatively strong advantage in labour costs, which are only 14% of Japan's and 12% of Korea's.

The Chinese government has recognised that this productivity gap has to be closed, and has set the objective of reducing the gap between Chinese shipbuilders and leaders in

the field by between one-third and one-quarter by 2010. One of the measures taken in response to this objective in the 11th Economic Plan was the building of co-operation with international companies and institutes, and as a result foreign direct investment of some USD 220 million was made in China's shipyards in 2005, up 45% from the previous year. Despite the need for the injection of foreign capital and expertise, China continues to enforce a cap of 49% for foreign shareholding in order to retain control over the industry.

Future developments

In recent years the capacity of China's shipbuilding industry has been undergoing a rapid growth compared to Japan, Korea and Europe, exploiting its natural advantages in low labour and other costs, attractiveness to Foreign Direct Investment, and the strong foundation of its existing shipbuilding sector.

The Chinese government has released its estimate of current and future global shipbuilding capacity, including the target of 23 million dwt set for Chinese shipbuilding capacity by 2010 (Table 8).

Table 8. **2010 global shipbuilding capacity forecast**

Location	2006 (million dwt)	2010 (million dwt)
Japan	29.4	32
Korea	25.3	32
Europe	5.3	6
China	14.52	23
Global	77.1	98

Source: 中國船舶工業綜合技術經濟研究院 (The Technology Research and Economy Development Institute, CSSC).

However, according to information released by CANSI in May 2007 (compiled nationally from shipyards), China's shipbuilding capacity will exceed 40 million dwt a year in 2010, if new yards planned by investors are completed as planned (Table 9). These estimates by CANSI indicate that this projected level is much larger than the plans of the Chinese government, which anticipated a total shipbuilding capacity of 23 million dwt at the end of the decade.

Table 9. **2010 China shipbuilding capacity forecast**

Province	2006 (million dwt)	2010(million dwt)
Shanghai	5.42	10
Jiang Su	3.28	10
Liao Ning	2.46	6.5
Zhe Jiang	1.17	6.5
Shan Dong	0.3	6
Guang Dong	0.66	2.5
China (total)	14.52	41.5

Source: COSTIND (2007).

The current expansion is largely driven by the very buoyant demand for new-buildings, which (if current trends are sustained) could result in an orderbook for local yards of around 73 million dwt by 2015. This has prompted the Chinese shipbuilding and

ship repair industries to embark on a number of facility development projects, ranging from new shipyard construction, yard relocations, facility modernisations and upgrades and the building of individual new docks and berths.

However, because of the growing risk of shipbuilding overcapacity, the Chinese government has implemented methods of control, including closing down unlicensed yards, denying licenses for enterprises with inadequate facilities, securing state approval for new enterprises exceeding 100 000 dwt in capacity, regulating investment of at least 2 billion yuan in new projects, and requiring the Chinese participation in equity joint ventures with foreigners to be at least 51% (Jim James, 2008).

Investment in existing facilities

Looking forward, CSIC and CSSC, the two state-run groups which account for three-fifths of the total shipbuilding capacity in China, are planning to conduct facility expansion in the near future as shown in the following tables.

Table 10. **Facility Expansion Plan of CSSC member shipyards**

Shipyard name	Facility expansion plan	Completion date	Planned capacity expansion (m.dwt)
Shanghai Waigaoqiao Shipyard	Expansion of capacity in two-phase construction	2008	2.60
Chang Xing Shipyard	Merger of Hudong Shipyard and Jiangnan Shipyard	2015	8.00
Zhongming Shipyard	Transfer of Shanghai Shipyard	2010	1.50
Nansah Longxue Shipyard	Merger of Guangzhou Wenchong and Guangzhou Shipyard	2008	3.00
		Total	15.10

Source: Suzuki (2006), compiled by Ludwig and Tholen (2006).

Table 11. **Facility Expansion Plan of CSIC Member Shipyards**

Shipyard name	Facility expansion plan	Completion date	Planned capacity expansion (m.dwt)
Dalian Shipyard	VLCC dock expansion	2009 – 2010	4.80
Bohai Heavy Industries	New VLCC dock expansion	2007	1.50
Haixi Wan Shipyard	Transfer of Qingdao Beihai Shipyard	2015	4.68
Qinhuangdao Shipyard	Shanghaiguan Shipyard (construction of JV shipyard)	2010	1.50
Tianjin Binhai Shipyard	Transfer of Xingang Shipyard	2011	3.00
		Total	15.48

Source: Suzuki (2006), compiled by Ludwig and Tholen (2006).

Green-field developments and modernisation/expansion plans

Recently, substantial investments in capacity have been made by emerging shipbuilding economies to take advantage of export market possibilities. These developments, many as green-field investment in new facilities, have been encouraged by government policies and frequently enjoy access to a variety of government assistance.

For its part, the Chinese Government set out clear goals in the 11th National 5-year Economic Plan to improve domestic capacities on research, design and innovation and to strengthen infrastructure capable of building larger and more complex ships. The measures taken by the Chinese government include:

- Measures to enhance the self-innovative ability of the industry and to promote the upgrading of its industrial structure and regulate its development;
- The promotion of investment and joint ventures;
- The development of domestic brands by encouraging the production of key components;
- Increase productivity and management skills, and enhance risk control.

More specifically, to increase the competitive edge of its shipbuilding industry, China encouraged technological advances in the shipbuilding industry through independent Chinese research and development, as well as tapping the foreign investment market through equity-for-technology and market-for-technology deals. This has enabled China to develop product manufacturing parks and production bases to facilitate the manufacture of advanced products.

As the body which oversees the industry, COSTIND has also laid out some plans to guide the future development of the Chinese shipbuilding industry to enable it to design and manufacture:

- High-tech, high-function and special ships, and large ships of 100 000 dwt and above;
- Passenger ships, ro-ro passenger ships, passenger-cargo ships and train ferries;
- LPG ships and LNG ships with a handling capacity of 5 000 cubic meters and above;
- Container ships with a capacity of 3 000 TEUs and above;
- Marine power systems, power plants and special support machines; design and manufacture of large deep-sea fishing boats, marine drill vessels, oil rigs, marine floating production storage and offloading (FPSO) structures and other offshore engineering equipment;
- Control and automation products, telecom and navigation equipment, instruments and meters and other marine equipment. (China View Website, 2006).

Indicators of future demand

This significant investment in new and expanded facilities will gradually come on-line at a time (expected to be around 2010/11) when demand for new-buildings may start to decline. Of course, as well as its own significant increases in capacity there will also be significant pressure from other emerging economies that are also making substantial investments in new capacity (Vietnam, India and the Philippines amongst others), and China's shipbuilders will have to operate in an increasingly competitive market. The relative vulnerability of the Chinese market because of its heavy dependence on a limited range of ship types (heavily weighted towards bulk carriers) has already been discussed.

It is impossible to foretell the future with respect to either eventual new-building demand, or the success of the Chinese industry to diversify its product base sufficiently to minimise (if not avoid) the impact of declining worldwide demand for new vessels. One potential indicator is to examine recent new orders (as opposed to existing orderbooks), in order to judge whether the Chinese shipbuilding industry is maintaining its momentum on new orders, and whether the significant reliance on bulk carriers is continuing (see Table 12).

Table 12. **New orders reported during 2007**

Location of build	Orders reported		
	Number of vessels	Million gt	Percentage
Korea	1,231	67.96	41.23%
China	1,698	58.01	35.20%
Japan	606	20.67	12.54%
Philippines	65	3.54	2.15%
India	115	1.92	1.17%
Chinese Taipei	27	1.22	0.74%
Germany	61	1.20	0.72%
Vietnam	72	1.48	0.90%
Rest of world	976	8.8	5.34%
Total	4,851	164.8	

Source: Lloyd's Register-Fairplay (2007), *World Shipbuilding Statistics*, December.

The first point to note is the strength of the Korean shipyards, which in 2007 captured more than 41% of total orders reported. Second, these numbers confirm that China has clearly overtaken Japan, which has slipped to record low proportions of world orders reported. Meanwhile, the Philippines and India are maintaining their recent strong showings, while Vietnam has failed to maintain its momentum. On this basis the Chinese shipbuilding industry must have some confidence that it can maintain a significant share of future orders. Table 13, compiled from 2007 quarterly statistics released by Lloyd's Register-Fairplay, shows the detailed Chinese new orders, by principal vessel types.

Table 13. **China – Reported new orders, 2007**

Ship type	Number of vessels	Million gt	% in million cgt
Bulk/Ore carriers	814	36.51	69.44%
Container vessels	166	5.42	10.31%
Crude oil/Oil prod tankers	87	4.52	8.6%
Vehicle carriers	40	1.91	2.26%
General cargo vessels	164	2.28	4.34%
Chemical/Oil product tankers	71	1.33	1.9%
LPG/LNG carriers	9	0.05	0.1%
Other vessels	132	0.56	1.06%
Total	1 419	52.58	

Source: compiled from statistics published in *World Shipbuilding Statistics*, Lloyd's Register-Fairplay March-December 2007.

The new orders reported in 2007 indicate a strong emphasis on bulk and ore carriers, a traditional strength of the Chinese shipbuilding industry. This outcome means that the proportion of these types of vessels in the orderbook will increase, with a commensurate decline in the proportion of container vessels, tankers and other ship types. The fact that container vessels overtook tankers as the second largest category over this period may be

an indication of future trends, which may be significant given that container vessels are generally more technologically complex than tankers.

Summary and conclusions

The global economy remained strong in the first half of 2007, with growth running above 5%. During the same period, China's economy, one of the current drivers of global economic growth was growing much more rapidly, at around 11.5%. However, the recent turbulence in global markets, while not greatly affecting the 2007 outcomes, has led to baseline projections for growth in 2008 being reduced by almost 0.5% to 4.8%.[18]

Despite this dip in confidence, the overall sentiment for global economic growth remains generally positive, and in consequence this can be expected to help sustain international trade at around current levels, thus maintaining a historically high level of demand for both bulk and container shipping. Global energy and resource demand, especially in the emerging economies, is expected to remain high, and these factors all indicate a continuation of strong demand for new vessels.

The Chinese shipbuilding industry has become one of the biggest in the world, and is continuing to expand vigorously. It has now overtaken Japan as the second largest in terms of the orderbook and new orders, if not as yet in production. It has been helped in this task by being considered as a key strategic industry to meet domestic need, enter the export market and act as a locomotive to encourage satellite industries. The 11th 5-year Economic Plan launched in 2006 has recognised the importance of the shipbuilding industry, which has been specifically included in a Five Year Plan for the first time.

The Economic Plan has set the goal for China to become one of the world's largest ship producers by around 2020, and the government has introduced a number of measures to facilitate this development. These measures include financial support, expansion of capacity, consolidation of the industry structure, upgrading the capability of manufacturing, research and design, strengthening technological co-operation with international companies and institutions, encouraging foreign investment and measures to tap into technological and business know-how. The government policies and measures provide effective incentives to industrial expansion plans.

However, while these ambitious plans are already underway, some hurdles and risks remain. In particular, the strong possibility of rapidly growing overcapacity is an increasing threat, especially if global growth stagnates. Since 2005, prices per vessel have started to decrease and several international institutes anticipate that the global shipbuilding market could be reversed in the next few years, which is when much of China's planned capacity expansion will be completed. Also, while China's natural advantages of lower production costs will remain, these are likely to deteriorate, particularly after the introduction of the new Labour Act in January 2008, unless it can also increase productivity and technological innovation to reduce the gaps that exist with its main competitors.

Annex. Major shipbuilding and repair yards in China

Name	Location (city/state)
4807 Military Shipyard	Fuan, Fujian
Baima Shipyard	Fuan, Fujian
Beihai Shipyard	Qingdao, Shangdong
Bohai Shipyard	Huludao, Liaoning
Boluomiao Shipyard	Guangzhou, Guangdong
Changzhou F.R.P Shipyard	Changzhou, Jiangsu
Changzhou Jianghai Hi-Speed MotorCraft Yard	Changzhou,Jiangsu
Changzhou Shipyard	Changzhou, Jiangsu
ChengAnWei Shipyard	Guangzhou, Guangdong
Chengxi Shipyard	Jiangyin, Jiangsu
China Shipping Industry Co. Ltd.(CIC)	Shanghai
Chongqing Shipyard	Chongqing, Sichuan
Chuandong Shipyard	Qingdao, Shandong
Chuanjiang Shipyard	Changshou, Sichuan
Dalian Shipyard	
Dalian New Shipyard	Dalian, Liaoning
DiGang Shipyard	Wuhu, Anhui
Dongfang Shipyard	Wenzhou, Zhejiang
Dongfeng Shipyard	Hangzhou, Zhejiang
Dongguan City F.R.P Shipyard	Dongguan, Guangdong
Dongguan Jianglong Shipbuilding Ltd.	Qingdao, Shandong
Donghai Shipyard	Shanghai
Dongtai Shipyard	Dongtai, Jiangsu
Fanyu Lingshan Shipyard	Qingdao, Shandong
Fujian Fishing Vessel Shipyard	Fuzhou, Fujian
Fuming Shipyard,Ningbo	Ningbo, Zhejiang
Fuyang Feiying Craft Ltd.	Fuan, Fujian
Gaohua Hi-Speed Ship Eng. Ltd	Wuhan, Hubei
Gezhouba Group Shipyard	yichang, Huber
Guangdong Ship F.R.P Factory	Qingdao, Shandong
Guangzhou Dengtai Shipping Ltd.	Qingdao, Shandong
Guangzhou Fanyu Xinghua Shipyard	Qingdao, Shandong
Guangzhou Gaohua Hi-speed Yacht Building Ltd	Qingdao, Shandong
Guangzhou Sea-Bus Eng. Ltd.	Qingdao, Shandong
Guangzhou Shipyard Internl	Guangzhou, Guangdong

Name	Location (city/state)
Guangzhou Fishing Vessel Shipyard	Guangzhou, Guangdong
Guangzhou Huangpu Shipyard	Qingdao, Shandong
Guang Zhou Wenchong	Guangzhou, Guangdong
Guangzhou Xinggang Shiprepairing Eng. Ltd.	Qingdao, Shandong
Guijiang Shipyard	Wuzhou, Guangxi
Haian Shipyard	Nantong, Jiangsu
Haidong Shipyard	Taizhou, Zhejiang
Haimen Shipyard,Nantong	Haimen, Jiangsu
Henan Huaibin Shipping Company's Shipyard	Qingdao, Shandong
Huaiyin Shipyard	Huaiyin,J iangsu
Huangdao Shipyard,of Qingdao Ship Corp.	Qingdao, Shandong
Huanghai Shipyard	Rongcheng, Shandong
Hubei Shipyard	Wuhan, Hubei
Hubei Tongheng Shipbldg Ltd.	Ezhou, Hubei
Hudong Shipyard	Shanghai
Jiangbei Shipbldg Ltd	Huanggang, Hubei
Jiangdong Shipyard of Changjiang Shipping Corp.	Wuhu, Anhui
Jiangdu Shipyard	Jiangdu, Jiangsu
Jiangfeng Shipyard	Wuhu, Anhui
Jiangmen Shipyard	Jiangmen, Guangdong
JiangNan Shipyard	Shanghai
Jianglu Shipyard	Wuhu, Anhui
Jiangsu Ganghang Group Canal Corp. Ship Repairing Factory	Huaiyin, Jiangsu
Jiangsu Jinghui Ship Eng. Ltd.	Taicang,J iangsu
Jiangxi Jiangxin Shipyard	Qingdao, Shandong
Jiangyang Shipbuilding Group Corp.	Yangzhou, Jiangsu
Jiangyin F.R.P Yacht Yard	Fuan, Fujian
Jiangyin Wuolong F.R.P. Craft Ltd	Fuan, Fujian
Jiangzhou Shipyard	Ruichang, Jiangxi
Jinling Shipyard of Changjiang NationalShipping Corp.	Nanjing, Jiangsu
Jingjiang Anchor Chain	Jinjiang, Jiangsu
Jingjiang Fishing Vessel Shipyard,Jiangsu	Jinjiang, Jiangsu
Jingjiang Shipyard	Jinjiang, Jiangsu
Jiuxin Shipyard	Shanghai
Kailing Shipyard	Zhoushan, Zhejiang
Lianyungang Shipyard	Lianyungang, Jiangsu
Lingshan Shipyard	Qingdao, Shandong
Linhai Jiannan Shipbuilding &Repairing Ltd.	Qingdao, Shandong
Mawei Shipyard	Fuzhou, Fujian
Mingjiang Shipyard	Ningbo, Zhejiang
Nanchang Shipyard	Nanchang, Jiangxi
Nanhai Shipyard	Qingdao, Shandong
Nantong Fishing VesselShipyard	Nantong, Jiangsu

Name	Location (city/state)
Nantong Ocean Ship Eng. Co	Nantong, Jiangsu
New China Shipyard	Guangzhou, Guangdong
Ningbo Daxie Development Zone Shipyard	Ningbo,Zhejiang
Ningbo Xinle Shipbuilding Ltd.	Qingdao, Shandong
Ningxunjie ShipbuildingCorporation(Ltd)	Ningbo, Zhejiang
Ningyu Ship Engineering Company	Qingdao, Shandong
Ocean Shipping RepairDockyard	Nantong, Jiangsu
Qingdao Shipyard	Qingdao, Shandong
Qingdao Yuandong Motor Craft Ltd	Fuan, Fujian
Qing Shan Shipyard	Wuhan, Hubei
Qiuxin Shipyard	Shanghai
Rongcheng Shipbldg Group Corp	Fuan, Fujian
Rudong County Shipyard	Rudong, Jiangsu
Sanxia Shipping Yard(Yingchang)	
Shandong Lunan Ship Group Corp.	Fuan, Fujian
Shanghai Shipyard	Shanghai
Shanghai Edward Shipbuilding Co., Ltd.	Shanghai
Shanghai Fishing Vessel Shipyard	Shanghai
Shanghai Hongxiangxin Shipyard	Shanghai
Shanghai HuaRunDaDong Shipping Engineering Co., Ltd	Shanghai
Shanghai LiFeng Shipyard	Shanghai
Shanghai Lixin Shipyard	Shanghai
Shanhaiguan Shipyard	Qinhuangdao, Hebei
Shangyou Shipyard	Fuzhou, Fujian
Shenjia Shipyard	Shanghai
Shenzhen Jianghui Ship Eng. Ltd.	Qingdao, Shandong
Shipyard of Yangzhou Shipping Company	Yangzhou, Jiangsu
Shunde Huaxing Shipyard	Qingdao, Shandong
Soonsan Shipyard (China)Co., LTD	Tongzhou, Fujian?
South China Shipyard	Guangzhou, Guangdong
Taicang Changjiang Shipyard	Taicang, Jiangsu
Tianjin Shipbuilding Company	Qingdao, Shandong
Tianjin Xingang Shipyard	Tianjin
Weihai Fishing Shipyard	Fuan, Fujian
Weihai Shipyard	Weihai, Shandong
Wuchang Shipyard	Wuhan, Hubei
Wuhu Shipyard	Wuhu, Anhui
Wuhu Dajiang Shipbuilding Ltd	
Wuxi Shipyard	Wuxi, Jiangsu
Wuxi Shipyard Zhangjiagang Sub-Yard	Zhangjiagang, Jiangsu
Wuzhou Shipyard	Wuzhou, Guangxi
Xiamen Shipyard	
Xiamen Fishery Shipbldg Ltd.	

Xijiang Shipyard	Liuzhou, Guangxi
Xingao Tech. Eng. Ltd.	Qingdao, Shandong
Xishan Hongsheng Shipyard	Xishan, Jiangsu
XinHua Shipyard, of Nanjing Jianghai Group Corp.	Nanjing,J iangsu
Yangfan Shipbuilding Industry Corp.(Group),Zhoushan	
Yangzijiang Shipyard	Jiangyin, Jiangsu
Yantai Fishing Vessel Shipyard	
Yantai-Raffles Shipyard	Yantai, Shandong
Yichang Sanhuan Ship Repairing Ltd.	
Yichang Zhongjiao Ship Ltd	
Yinghui Nanfang shipbuilding Ltd,Fanyu	Qingdao, Shandong
Yizheng Shipyard	Yizheng, Jiangsu
Zhangjiagang Shipyard	Zhangjiagang, Jiangsu
Zhenjiang Jianbi Shipyard,of the Capital Steel Group	Fuan, Fujian
Zhejiang Leqing Changhong Shipyard	Leqing, Zhejiang
Zhejiang Qiligang Shipping Group Dongfang Ship Repairing Factory	Fuan, Fujian
Zhenjiang Shipyard	Zhenjiang, Jiangsu
Zhejiang Shipyard	Qingdao, Shandong
Zhejiang Zhoushan Dinghai Panzhi Shipyard	Zhoushan, Zhejiang
Zhoushan Fishing Corp. Fishing Vessel Factory	Fuan, Fujian
Zhoushan Wuyang Shipyard	Zhoushan, Zhejiang
Zhoushan Xingye Ltd. Shipyard	Fuan, Fujian
Zhufan Alu. Alloy Shipbuilding Ltd.	Zhuhai, Guangdong
ZhongHua Shipyard	Shanghai
Zhoushan Shipbuilding Industry Corp.	Zhoushan, Fujian
Zhuhai Haizhima yacht Factory	Qingdao, Shandong

Source: China Shipyards Directory (2002).

Notes

1. According to statistics released by the Commission of Science, Technology and Industry for National Defence (COSTIND), the yearly output of the Chinese shipbuilding industry in 2006 reached 14.52 million dwt, ranking third in the world. COSTIND's statistics of August of 2007 also showed that in terms of new orders (42.62 million dwt) and orderbook (105 million dwt), China was ranked second in the global shipbuilding market.
2. For information on recent changes to COSTIND please see The role of government, p. 43.
3. As of September 2007, the production outputs of Dalian Shipbuilding and Shanghai Waigaoqiao were 3.32 million CGT and 2.28 million CGT, respectively.
4. The cited information was provided by the China Shipbuilding Economy Research Center.
5. Comments made by Hu Yafeng, Deputy Secretary General of COSTIND, at the China (Wuhan) International Marine Equipment Industry Development Forum, 23 September 2007, Wuhan.
6. Such facilities include those in Bohai Sea in the north, the outlet of the Yangtze River near Shanghai and the outlet of the Pearl River near Guangzhou in the south.
7. According to an official statement released by the Chinese government, the 11th National People's Congress, held in March 2008, decided that in order to reduce the size of the central government to 27 ministries and councils, COSTIND and three other ministries would be integrated into a new Ministry of Information Industry (MII). Two new agencies were created under the MII, of which the Bureau of National Defence Industry is expected to take the responsibility for China's shipbuilding industry.
8. Transmitted in private correspondence to the OECD.
9. Information provided by the China Shipbuilding Economy Research Center.
10. According to a special report "*China Eximbank puts foreign trade on sound footing*, prepared by the China Daily in May 2005 at *http://app1.chinadaily.com.cn/fortune2005/ft050517p31n.pdf*.
11. Information provided by the China Shipbuilding Economy Research Center.
12. Information provided by the China Shipbuilding Economy Research Center.
13. Source cited from民用船舶工業發展"十五"計畫綱要(Guidelines for the 10th national five-year Economic Plan), 2005年1月21日.
14. Transmitted in correspondence to the OECD.
15. Lloyd's Register-China Site at *http://www.lr-china.org/en/news+events/newsItem.php?newsID=10*.
16. The statistics were released by COSTIND in March 2007 referring to"2006年全國船舶工業經濟運行報告"("Annual report on national shipbuilding industry, 2006").
17. According to the statistics in 2005, published by Chinese Customs, the total ship exports amounted to US$4.66 billion.
18. According to the statistics and forecast of the World Economic Outlook, released by the IMF (International Monetary Fund) in October 2007.

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The shipbuilding industry in Viet Nam

Ozgur Umut Senturk*

This report on the shipbuilding industry in Viet Nam is one of a series of such reports intended to provide an insight in the shipbuilding sector of both OECD and non-OECD economies.

* This work is published on the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein are those of the author and do not necessarily reflect the official views of the Organisation or of the governments of its member countries. This report benefited from detailed comments provided by Vinashin, the principal state-owned shipbuilder in Viet Nam, which is thanked for its participation.

Introduction

Viet Nam's recent past is a remarkably successful story of economic growth and transition. From a position 15 years ago as a closed economy, almost completely dominated by the state, Viet Nam now has a mixed economy with a dynamic and increasingly competitive private sector. As an example of the opening up of the Vietnamese economy, there are currently an estimated 2 000 state-owned enterprises in Viet Nam, whereas 20 years ago there were 12 000.

This transition has been achieved through the effective liberalisation of markets as well as economic reforms and new laws regulating Foreign Direct Investment (FDI), and business relations with foreign investors that are strictly enforced by the government. This in turn has led to confidence in the economic system increasing rapidly, as Viet Nam has become one of the best performing developing economies in the world. A fast growing economy, political stability, good market potential and a cheap labour force are some of the reasons for the entry of many foreign companies into the Vietnamese market.

Shipbuilding is one of the major industries in the Vietnamese government's economic development strategy[1] and ambitious plans have been adopted to improve the competitiveness of its shipbuilding and maritime transportation industries in the international market. The government supports the shipbuilding sector in the achievement of the stated ambition of becoming one of the major shipbuilding nations, and has given priority to the development of industrial parks and export processing zones. These are intended to attract enterprises specialising in maritime facilities as well as production of high-grade components and materials.

Snapshot of Vietnamese shipbuilding industry development

Shipbuilding is a very attractive industry for developing nations as it can bring in substantial amounts of foreign currency, due to transactions in the market being largely carried out in USD. Japan used shipbuilding in the 1950s and 1960s to rebuild its industrial structure and South Korea made shipbuilding a strategic industry in the 1970s. At present, both Viet Nam and China are in the process of repeating these models with large, state-supported investment in this industry.

The Socialist Republic of Viet Nam has seen an economic boom in the last few years that is similar to that experienced by China. The Vietnamese shipbuilding sector is part of this growth and is developing rapidly by attracting many foreign investors from the EU, Japan and Korea. Investing companies include MAN B&W Diesel, Hyundai Mipo Dockyard, Aalborg Industries, Mitsubishi Heavy Industries.

With a coast line of more than 3 200 km, low labour costs and increased potential for domestic waterway transportation, Viet Nam has considerable potential to develop its shipbuilding industry. One of Viet Nam's principal attractions for foreign shipbuilding companies has been its large, literate[2] and relatively low cost labour force. Now estimated at 44 million, the labour pool continues to increase by over 1 million workers annually due to the rapid post-war population growth (US Foreign Commercial Service and Department of State, 2005).

When Vinashin (Viet Nam Shipbuilding Industry Corporation – currently Vinashin Business Group) – was established in 1996, it had only 23 subsidiaries with poor facilities that could build vessels. Now Vinashin, the national shipbuilding corporation responsible

for co-ordinating shipbuilding throughout the country, is developing rapidly, with the goal of consolidating and improving national resources and capabilities in order to construct vessels for export. Viet Nam now has around 60 shipbuilding and repairing enterprises, mostly owned by the ministry of Transportation (through Vinashin), the ministry of National Defence, and the ministry of Fisheries (Borgersen, 2004).

In Viet Nam some facilities serve as both new building and repair shipyards, but generally it is a relative new comer to the large ship repair scene. Viet Nam has possessed for some time docks able to take ships of up to about 15 000 dwt, but a dramatic uplift in capacity came in 1999 with the opening of new yards by the Hyundai Vinashin Shipyard Company (HVS) – a joint venture with Korea's Hyundai Mipo Dockyard – which are strategically located to cater for vessels that trade between the Far East and Europe.

Geographic distribution of principal construction facilities

When Vinashin started its modernisation programme in 1996, it had only ten small shipyards, all centred in the northern part of the country around Haiphong. These were all located on rivers and were limited to building vessels of up to 6 500 dwt. In the first phase, Vinashin built up the capacity and quality of its existing yards and in the second phase, which began five years ago, started to build new yards to increase the overall capacity of the group.

In Viet Nam, the principal construction facilities are located in three clusters: Southern, Central and Northern. Each cluster has some advantages and disadvantages, and these are illustrated in Table 1.

Table 1. **Geographical clusters in Viet Nam**

Geographic location	Advantages	Disadvantages
South Cluster	Better infrastructure (ports, roads, telecoms) Major concentration of existing FDI Largest domestic market for "higher priced" products	Far from political decision centres Higher competition from local and foreign companies
Central Cluster	Lowest costs (labour, land etc.) Easy access to specific inputs (raw material and commodities) Low competition	Poor infrastructure Limited FDI Higher administrative and regulatory uncertainties. Limited local markets
North Cluster	Proximity to political decision centres Most State Owned Enterprises have HQs here More efficient for special or politically sensitive projects Satisfactory infrastructure (including Haiphong port) Large local market Easy access to specific inputs (notably minerals)	Stronger bureaucratic hindrances and difficulties related with foreign investment

Source: ASIA INVEST (2002), *Guidebook for European Investors in Vietnam*, European Commission Asia Investment Facility, Luxembourg.

According to Viet Nam's existing expansion program, the Northern cluster will focus on container ships and tankers of around 70 000 dwt; the Central cluster on ships between 250 000-300 000 dwt; and the Southern cluster on ships of 30 00 dwt. The main yards in the clusters are listed in Table 2.

Table 2. **Major shipyards in Viet Nam**

Geographic location	Name of Shipyard	Province/Municipality	Building/Repair (B / R)
Southern Cluster	Saigon Shipyard	Ho Chi Minh City	B/R
	CK 76 Shipyard	Ho Chi Minh City	B
	Hoang Anh Shipbuilding Industry	Nam Dinh	B
	Can Tho Shipyard	Can Tho	B
	Aker Yards Viet Nam	Vung Tau	B
Central Cluster	Dung Quat Shipyard	Quang Ngai	B
	Hyundai – Vinashin Shipyard	Khanh Hoa	B/R
	Nha Trang Shipbuilding Industry	Khanh Hoa	B
	Da Nang Shipyard	Da Nang	B/R
	Song Han Shipyard	Da Nang	B
	Phu Yen Shipyard	Phu Yen	B
Northern Cluster	Ha Long Shipyard	Haiphong	B
	Bach Dang Shipyard	Haiphong	B/R
	Nam Trieu Shipyard	Haiphong	B
	Song Gia Shipyard	Haiphong	B
	Pha Rung Shipyard	Haiphong	B/R
	Ngo Quyen Shipbuilding Industry	Haiphong	B/R
	Nghi Son Shipyard	Thanh Hoa	B/R
	Ben Thuy Shipyard	HaTinh	B/R
	Ben Kien Shipyard	Haiphong	B
	Song Cam Shipyard	Haiphong	B/R
	Song Lo Shipyard	Phu Tho	B
	Nam Ha Shipyard	Nam Dinh	B
	Tam Bac Shipyard	Haiphong	B
	Thanh Hoa Shipyard	Thanh Hoa	B
	Hai Duong Shipyard	Hai Duong	B/R
	Red River Shipbuilding Industry	Hanoi	B/R

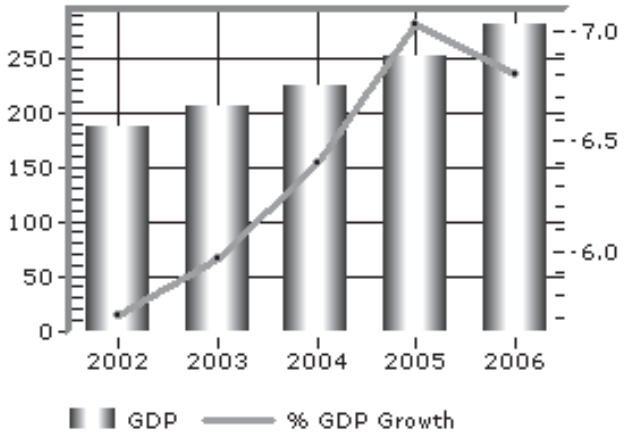
1. Administratively, Viet Nam consists of 59 provinces and 5 municipalities. The provinces and municipalities are subdivided into towns, districts and villages. The provinces and municipalities are centrally controlled by the national government, while the towns, districts and villages are locally accountable to some degree through elected people's councils.0 dwt. The main yards in the clusters are listed in Table 2.

Source: Compiled by the OECD secretariat.

The role of shipbuilding in the Vietnamese economy

In 1986 Viet Nam adopted an overall economic renovation policy, popularly called "Doi Moi",[3] and consequent comprehensive reforms. Viet Nam has become one of the fastest growing economies in the world, and pulled itself out of the deep economic crisis of the late 1980s. Inflation was reduced from three digit numbers in the late 80s to single digit numbers in the 90s, and has been kept low ever since. As illustrated in Figure 1, GDP doubled in the 1990s and is continuing to grow rapidly. Exports have also grown at an annual average rate of nearly 20% since 1993, rising from less than USD 1 billion in 1987 to USD 39.6 billion in 2006.

Figure 1. **Viet Nam GDP PPP (Billion USD) and GDP growth rates, 2002-06**



Source: EIU economy data.

Viet Nam's economy grew by around 8.5% in 2007, one of the highest rates in Asia, having grown by an average of 7.5% annually in the previous decade. As it continues to develop rapidly, bank lending is expanding quickly (by 37% in 2007) and there is very strong demand for building materials and equipment, exacerbating the risk of the economy overheating[4]. The World Bank has launched the Global Economic Prospects 2008 (GEP 2008), noting that Viet Nam's economy is expected to grow at 8.2% in 2008 and 8.3% in 2009.

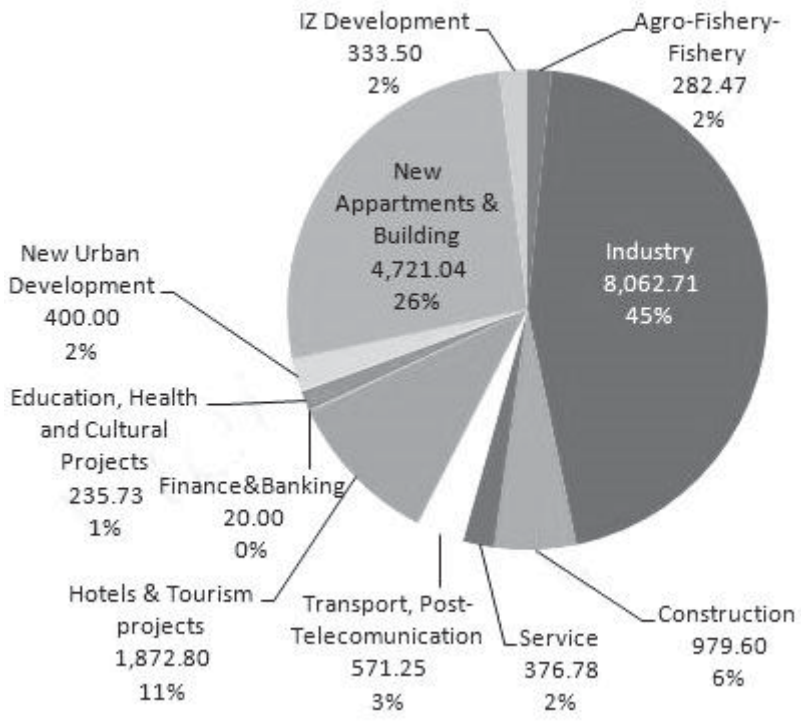
Foreign direct investment (FDI) has played an important role in Viet Nam's recent economic growth. It has provided capital, technology, know-how and market access, and the growth in industrial output resulting from FDI has exceeded that of the state sector for more than a decade. Neighbouring Asian economies are the dominant source of FDI, with the top five investor economies being Singapore, Chinese Taipei, Japan, South Korea and Hong Kong (China). The domestic private sector growth has also accelerated since the late 1990s, and is now increasing at a consistently higher rate than that of the state sector.

From a broader investment perspective, increasing domestic demand, a high level of FDI of around USD 10 billion, and significant domestic investments made a significant contribution to the GDP growth in 2006 as illustrated in Figure 1. The industry and construction sector maintained its important role with 10.4% growth in 2006, with Viet Nam expecting FDI for its heavy industry (which includes shipbuilding) to be around 45% of the USD 17 855 billion total in 2007 as shown in Figure 2.

Viet Nam's accession to the World Trade Organization as the 150th member economy, which was completed officially in January 2007, is expected to provide an important boost to the economy and ensure the continuation of liberalising reforms. The Economist Intelligence Unit (EIU) expects strong real GDP growth, driven by buoyant consumption and investment. For its part, Viet Nam has the ambition to become a middle income economy by 2010 and is strongly committed to reaching its Millennium Development Goals in 2012.[5]

Figure 2. **Viet Nam FDI capital classified by industry, 2007**

17 855 million USD, 1 445 projects



Source: Viet Nam FDI Statistics.

Shipbuilding as a strategic industry

The shipbuilding industry affects the Viet Nam economy in various positive ways, such as supporting the shipping industry, increasing employment, assisting the development of technology in all shipbuilding related industries, stimulating demand for domestic products and increasing foreign currency inflow. The Vietnamese Government has made shipbuilding a key export industry, and in the past five years it has boosted investments within the scope of the Shipbuilding Industry Development Program 2002-10. Its shipbuilding industry is growing rapidly and creating good opportunities for foreign companies that provide marine equipment and services. The Vietnamese shipbuilding industry first came under the international spotlight in 2004 when Vinashin entered into an agreement with the UK's Graig Group for the construction of 15 DNV-classed 53 000 dwt bulk carriers[6] (Brewer, 2006).

Relationship with other industries

The Vietnamese maritime sector is developing rapidly and Viet Nam's stated ambition is to have a shipbuilding industry with a technology level equal to that of other regional economies. The availability and cost of material inputs are significant factors which affect the competitiveness of the shipbuilding industry, and in Viet Nam these account for more than 70% of the total costs of building a ship. At present Vietnamese shipyards import the majority of their materials and machinery, due to the inability of domestic production to meet demand, but Vinashin's strategy is to increase the rate of

domestically manufactured products to 60-70%, which in turn will create favourable circumstances that could encourage the development of other industries.

Viet Nam is on the road to becoming an industrialised nation, and the demand for steel is growing due to the emerging industrial sector and the many infrastructure projects in the country. The steel market is one of the important factors that directly affect shipbuilding, as steel represents roughly one-fifth of the total cost of building a typical tanker. In addition, any increase in steel prices will typically force up the price of other materials and equipment.

The Vietnamese government approved a blueprint for steel development during the period 2007-25, which requires producers to meet local demand with a surplus for export. Under the blueprint, an estimated USD 10-12 billion will be needed to produce 12-15 million metric tons of steel ingot and 19-22 million metric tons of steel products per year by 2025, with local producers eventually creating surplus production for export. Some additional information on specific plans is covered below.

In the last ten years, demand for steel in Viet Nam – which has limited domestic facilities and is an importer of steel plate and ingots – has risen by an average of 20% per year, and the current annual demand of 6 million tons is set to rise to approximately 15 million tons by 2015. In 2005, steel imports amounted to 5.5 million tons, equalling almost 90% of consumption. Viet Nam had produced 1.33 million tons of steel by the end of July 2007, an increase of 25.4% over the same period in 2006 (SEAICI 2007), and intends to reduce its heavy dependence on imports, in particular of warm-rolled and cold-rolled flat products, by securing additional investments in new facilities.

The Viet Nam Steel Corporation is aiming to produce 2.35 million tons of steel in 2008. The cheap steel imported from China was one of the biggest challenges that the corporation faced in 2007 since China's steel exports have strongly affected the Vietnamese steel market.[7]

A contract for setting up a joint venture between Vinashin and Songsan CNI Ltd (Korea) was signed in March 2007, and will start operation in the 2nd quarter of 2008. It is expected to provide a stable annual steel processing capacity of 108 000 tons by 2017 in order to manufacture and assemble steel blocks for shipbuilding projects. The shipyards within the Vinashin Group will enter into contracts with this joint venture for manufacturing high quality steel blocks with the purpose of shortening the shipyard's construction time.

POSCO, South Korea's largest steelmaker also has an expansion plan in Viet Nam with a project to build a USD 1.13 billion integrated steel mill in the Phu My II industrial zone. This mill, which would be capable of producing around 3 million mt[8]/year of rolled steel, is scheduled to begin operations by late 2009.

The Lion Group of Malaysia reported that it is considering building a USD 7 billion steel mill in Viet Nam. The team is conducting a feasibility study and once completed, a consortium will be formed to manage the steel mill project.

India's Essar Group signed a joint-venture contract with the Viet Nam Steel Corporation (VSC) and Viet Nam's main rubber manufacturer Geruco to build a USD 527 million hot rolled steel mill in southern Ba Ria-Vung Tau Province. Also, India's Tata group has signed a memorandum of understanding to invest USD 3.5 billion in a steel complex in central Ha Tinh province with an output capacity of 4.5 million mt/year.

A Vietnamese-Thai joint venture involving the domestic Hoa Sen Joint Stock Company plans to construct a USD 60 million steel mill, and a USD 30 million steel-building materials factory, in Phu My II industrial zone.

The market has also witnessed strong competition among local producers. The Thep Viet Joint Stock Company has invested USD 100 million in a steel ingot plant in Phu My Industrial Zone with a capacity of 500 000 mt/year. The plant is understood to be currently undergoing trial runs and is expected to be officially put into operation by late 2007. The company also plans to build a USD 1.5 billion rolled steel plant with a capacity of 3 million mt/year by 2015.

Vinashin, the Vietnamese multi-sector corporation, aims to establish a steel integrated mill, scheduled to open in 2008, with a capacity of 4.5 million tons per year in Ninh Phuoc district. In the first stage, between 2008-10, Vinashin will develop the project at an estimated cost of USD 2.7 billion. The remaining capital will be transferred into expanding the mill over the next 8 years.

To further reinforce the Vietnamese desire to achieve domestic self-sufficiency in steel production, the import of steel scrap doubled in 2007, as supply for steel ingot production is falling short of growing demand. According to the Viet Nam Steel Association, the Vietnamese steel industry imported 700 000-800 000 tonnes of steel scrap in 2006, 1.4 million tonnes in 2007 and an estimated 2 million tonnes in 2008.

With respect to the needs of the shipbuilding industry, the Vietnamese state-owned shipbuilding group Vinashin owns high capacity steel rolling facilities, and will be able to produce most of the heavy plate and special steel products that it requires to meet its future demands,[9] so it may not be dramatically affected by the heavy demand placed on steel production by other industry sectors.

Vietnamese government policies

The role of government

The government of Viet Nam has accorded a high importance to shipbuilding, and has been supporting the sector within the scope of its sector support programme. This programme provides considerable support to the sector (BLP, 2005) including:

- Providing Vinashin with loans on advantageous terms.
- Allowing the corporation to retain total corporate income tax and capital-use tax[10] for the period 2002 to 2010 for reinvestment.
- Exemption on export taxes and land rent.
- Government covers up to 50% of working capital available to State Owned Enterprises (SOE).
- The State Development Fund provides loans with 12 months payback and 2 years grace period for the infrastructure costs of new shipyard projects.
- Restriction of second-hand ship imports.[11]

Furthermore, the Viet Nam Shipbuilding Industry Strategic Development Programme 2001-15 has mapped out the following general objectives of a development programme which include three implementation phases (Vinashin Business Group, 2006):

Period 2001-05

- Upgrade shipyard capacities for building dry cargo ships up to Handymax size.
- Technical preparations for construction of more complicated vessels such as Aframax tankers and Ro-Pax in phase 2.

Period 2006-10

- Further upgrade and modernize shipyard technology to a level equal to mid-class shipbuilding economies.
- Domestic production of shipbuilding material and equipment such as steel plates, marine engines (2 and 4 strokes), hatch cover and cranes up to 70% of a ship value.

Period 2010-15

- Manage modern shipbuilding technology for offshore structures and for vessels up to 150 000 dwt (VLCCs).
- Attain a solid position in Ro-Pax market.

Financing and guarantee schemes

The Investment and Development Bank of Viet Nam (BIDV) is mainly responsible for the guarantee of repayment of loans, as well as refund guarantees on advance capital in the shipbuilding sector. However, it also co-operates with other banks such as the Viet Nam Foreign Trade Bank (VCB), the Viet Nam Industrial Commercial Bank (Vietincombank), the Agriculture and Rural Development Bank (Agribank) and the Saigon Joint-Stock Commercial Bank to cover large amounts.

More specifically, the Viet Nam Shipbuilding Finance Company has been working closely with the Vinashin Group and its subsidiaries to find financing solutions similar to the co-operative relationships established between Vinashin, the Viet Nam Development Assistance Fund and various banks (ABS, 2007).

In 2004, the Viet Nam Maritime Commercial Joint Stock Bank and the Viet Nam Investment and Development Bank (BIDV) jointly signed a credit agreement with Ha Long Shipyard for VND 100 billion (USD 6.36 million) to build a number of 12 500 dwt vessels. This and other agreements[12] have brought new, sustainable and long-term viability to Viet Nam's shipbuilding sector.

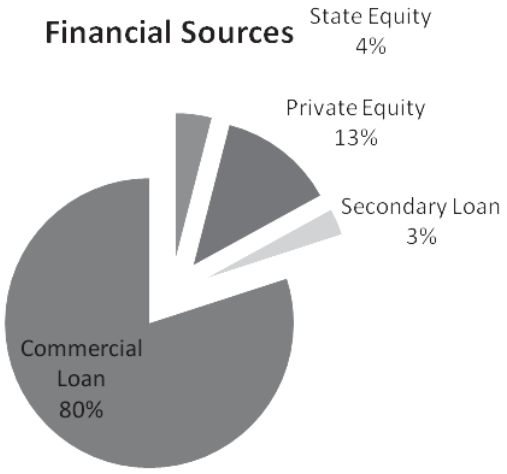
In 2005, Viet Nam issued its first global bond raising valued at USD 750 million, with the entire amount loaned to Vinashin to fund its expansion. Since then, to reduce borrowing costs, many Vietnamese companies – including Vinashin – have switched from bank loans to bond issues in order to reduce interest charges from 12–15% to around 10%. Most recently, Vinashin issued its third 10-year corporate bond valued at VND 3 trillion (USD 187.5 million), of which around 95% was sold to offshore investors.

State-owned Viet Nam National Shipping Lines (Vinalines) is planning a USD 309 million bond issue at the end of 2008 to buy four Aframax tankers from Vinashin and is working with Crédit Suisse on debt ratings before deciding on the timing of its first international bond issue. Moreover, the USD 130 million loan that it recently signed with

Citigroup will be used to buy five cargoships. Vinalines is undertaking a major expansion programme with Vinashin, and signed contracts with the yard for the eventual production of 64 vessels at a total cost of USD 2.5 billion.

Today, Vinashin has an orderbook of around 14.4 million dwt,[13] of which roughly 70% comes from overseas, and this has forced Vinashin to invest heavily in its shipbuilding facilities in order to meet this strong demand for large vessels. To finance this expansion, in 2006 Vinashin raised investment capital totalling VND 15 trillion (USD 937.5 million), an increase of between 35-45% over the previous year. Vinashin also has a target of raising the ranking of Viet Nam's shipbuilding industry to fourth in the world by 2015, and to achieve this will require an estimated capital expenditure of USD 5.14 billion by 2011, as illustrated in Figure 3 (Vinashin Business Group, 2006).

Figure 3. **Source of US$ 5.14 billion capital**



Source: Vinashin Business Group (2006).

This USD 5.14 billion capital for the period 2008-11 would be allocated as follows:

- Shipbuilding/repair (USD 1.4 billion)
- Shipping (USD 2.05 billion)
- Heavy industries (USD 1.13 billion)
- Construction (USD 0.37 billion)
- Trading and others (USD 0.15 billion)

R&D and innovation

The Shipbuilding Science and Technology Institute (SSTI) was established in 1959 in Hanoi, and is Vinashin's largest subsidiary company focusing on R&D. At its height it employed about 500 engineers, but in the intervening period this had shrunk to as low as 50. With the formation of Vinashin in 1996, and a national commitment to commercial shipbuilding, SSTI acquired a new mission at the front line of the country's developing shipbuilding industry, and began to grow again. Its staff built knowledge and experience

by training abroad in Japan and Korea, and engaging in joint ventures with foreign design offices. The Institute maintains a Ship Research and Test Center which includes a model ship testing basin, and has a close relationship with foreign design institutes such as Hitachi Zosen (Korea), Carl Bro (Denmark), Kitada Ship Design Co. (Japan) and CTO (Poland).

Today SSTI employs 250 naval architects and marine engineers and focuses mostly on providing design and engineering services. In 2007, SSTI took a role in the country's highest profile shipbuilding project by commencing the design of the first Aframax tankers (115 000 DWT), in cooperation with American Bureau of Shipping (ABS). These are currently under construction in the Dung Quat yard. SSTI's next design projects are expected to be for a 3 200 teu container feeder vessel and an MR (medium range) product tanker.

The institute has designed a range of vessels, including cargo ships, tankers, floating docks, barges, small passenger and tug boats. Vinashin is planning to upgrade the SSTI and its model testing basin in order to allow for the design of vessels up to 100 000 dwt. The Dung Quat Shipbuilding Corporation and the Oil and Gas Shipping Investment Joint Stock Company signed a contract in 2006 to construct 54 000-dwt freighters that were designed by the SSTI.

In 2005, SSTI began working with Poland's Ship Design and Research Center to co-operatively design and build container ships and crude oil carriers, as well as the development of a new testing basin for models. That basin is now under construction in Hoa Lac High-Tech Park, and is scheduled to be ready for operation by the end of 2008. Polish experts have trained SSTI engineers in the operation of the basin and supplied the institute with new equipment, including a cavitation tunnel and a wave maker (ABS, 2007).

SSTI's immediate goal is to entirely produce its own designs of vessels of up to 170 000 to 200 000 dwt by 2010. Its future plans include expansion into education, with a training school and maritime technical academy specialising in shipbuilding and naval architecture. The institution's expected student throughput is around 1 500 per year, and the academic network will extend to a number of branches throughout the country. Construction of facilities has already begun at one site.

The design for offshore development is among the SSTI's long term goals, and it has a branch office for future offshore projects in Vung Tau, the area south of Ho Chi Minh City, that is becoming the country's oil and gas services centre.

The Viet Nam Maritime University (VIMARU) has developed rapidly[14] over the past years and also set up the Research Center of Ship Technology Application. This centre focuses on shipbuilding, ship repairs, marine equipment as well as wharf designs.

Industry structure

Analysis of the structure of the Vietnamese shipbuilding industry

In Viet Nam, the Ministry of Transport (MOT) is responsible for all transport modes such as maritime, road, railway, air and inland water transport. Its responsibilities in the maritime sector include ship building and related services, as well as ports and regulatory matters. Vinashin is the country's principal shipbuilding company, and reports directly to

the Prime Minister, as well as to the MOT on state administrative matters (ASEAN 2005). Vinashin was founded in 1996 as one of the largest state owned enterprises of Viet Nam, and was itself based on the Viet Nam Shipbuilding Union, established in 1972 (Vinashin Business Group 2006). The key elements of Vinashin's structure are as follows:

- Vinashin is a holding company with over 200 subsidiaries including:
  - around 28 shipyards;
  - Vinashinlines including 5 shipping companies (Vinashin Ocean Shipping Lines, Bien Dong Shipping Company Vinashin Coastal Lines, Vinashin Oil and Gas Shipping Lines, Mekong Shipping Company);
  - 9 engineering and construction companies;
  - 12 joint venture companies including Hyundai-Vinashin Shipyard, Visco, Vinashin Sejin Marine Accommodation Co., Baikal Shipping, Shell Gas, Viet Nam-Korea Ship Demolition Co., Viet Nam-Canada Ship Repair Corporation;
  - 20 manufacturing companies;
- Headquartered in Hanoi with about 300 employees.
- It has also established representative offices in Germany, Holland, Poland, Russia, Australia, Korea, Iraq and the United States in order to enter the international market.

Vinashin established a vessel owning subsidiary named Vinashinlines. Alongside Vinalines, the traditional national shipowners, this created two umbrella organisations for maritime transport in Viet Nam. The main purpose of forming Vinashinlines was to give Viet Nam's shipyards a client and a venue for demonstrating their abilities to construct world-class vessels, and initially to give the world maritime community a sense of security about ordering from shipbuilders that did not have an international track record. Vinashinlines entered the business with several small tankers importing oil products to Viet Nam and a series of multipurpose dry cargo ships in the 12 000 to 15 000 dwt range. Today, through its five subsidiary firms, Vinashinlines owns a fleet of nine bulk carriers, two tankers and two container ships with a total capacity of about 350 000 dwt. By 2010 the company expects to raise its fleet to 44 vessels with a total of 1.5 million dwt (ABS 2007).

Ownership structure, joint ventures, foreign participation

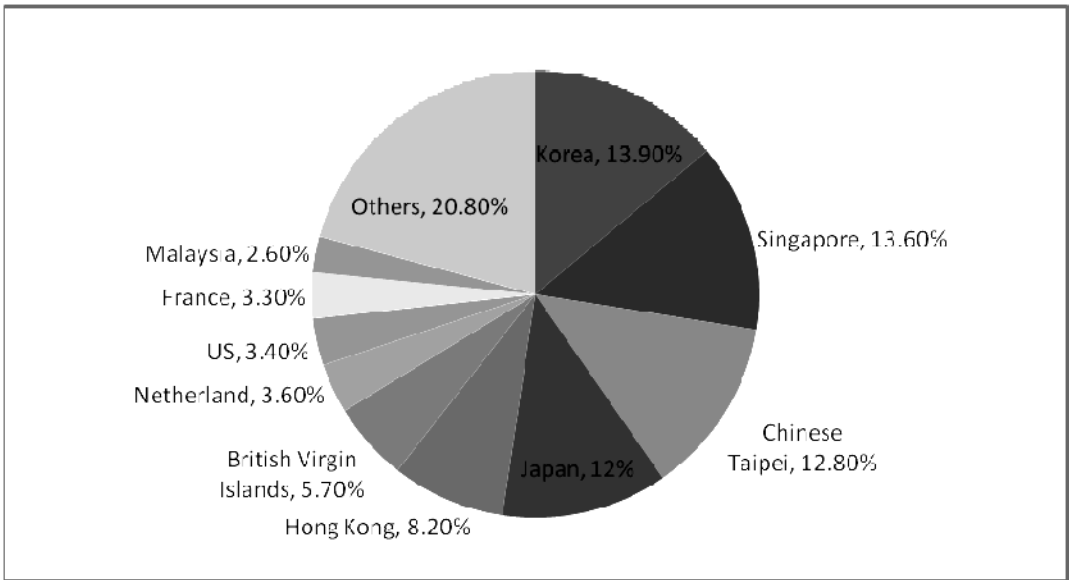
The current healthy state of the global shipbuilding market, which has resulted in virtually full orderbooks for most of the major international shipyards, has pushed ship owners towards new destinations in the search for new suppliers. Viet Nam is promoting its shipbuilding industry through the state owned group Vinashin, which owns around 70% of the shipbuilding capacity, and whose shipyards are mostly situated near big ports such as Hai Phong and Ho Chi Minh City.

Most of the large shipyards in Viet Nam are under the management of Vinashin, which operates on the parent-subsidiary model. Therefore, foreign companies enter into the Vietnamese shipbuilding sector mainly by setting up joint ventures that result in the creation of new entities or by acquiring the shares of local shipyards.

From an industry-wide perspective the mechanisms used by foreign participants when investing in Vietnamese enterprises are: Full (100%) foreign ownership (85.7% of total projects), Joint Ventures (10.6%), Business Co-operation Contracts (1.1%) and Joint Stock (2.6%)F Over the past two decades (and as of June 2007), the top ten investor economies in Viet Nam (see Figure 4) were (Huan, 2007):

South Korea (USD 9 365 million)	Singapore (USD 9 191 million)
Chinese Taipei (USD 8 621 million)	Japan (USD 8 067 million)
Hong Kong (USD 5 505 million)	British Virgin Islands (USD 3 819 million)
Netherlands (USD 2 429 million)	USA (USD 2 319 million)
France (USD 2 249 million)	Malaysia (USD 1 740 million)

Figure 4. **The ten largest foreign investors in Viet Nam as of June 2007**



Source: Viet Nam Foreign Investment Agency, 2007.

On the other hand, Vinashin has a number of strategic partners that are not investors, where those partners work together in a variety of ways to improve the quality of ships and of meeting delivery dates. These strategic partnerships also aim to increase efficiency in terms of reducing cost levels and improving capacity usage, in order to cope with both increasing domestic and foreign new shipbuilding orders.

For example, Poland has played an active part in the development of the shipbuilding industry in Viet Nam, and Vinashin has imported equipment worth more than USD 50 million from Polish companies, as part of a USD 70 million credit agreement between Poland and Viet Nam (AMEM, 2005). The Dutch Government has also implemented soft credit programmes to promote trade and investment co-operation with Viet Nam for its marine equipment sector.

Special Economic Zones in Viet Nam

Many foreign investors have commented that in Viet Nam it is faster and more convenient to implement projects in the Industrial Zones than outside those zones, as there the land use is already planned and they need not be involved in site clearance, compensation works and the construction of necessary infrastructure, all of which are time consuming and sometimes difficult (US Department of State, 2007). Shipbuilding companies in Viet Nam may choose to construct vessels in two different types of Special Zones:

Economic zones (EZs) have been developed as designated areas targeting foreign investors willing to locate their production base in Viet Nam while exporting 100% of their production. Subject to specific provisions, shipbuilding companies operating in EZs can take advantage of exemptions from customs duties for equipment, raw materials, commodities imported into the zones and for finished goods and products exported from the zones.

Industrial zones (IZ) have been developed to accommodate both foreign and local companies, targeting both domestic and export markets, with the idea of providing better infrastructure and easier routes for procedural approvals. Considering that the fiscal incentives initially reserved for EZs have now been extended to those companies located in IZs that export at least 80% of their production, the IZs[15] are by far the most common form of 'special zone' in Viet Nam.

Vinashin has invested in the establishment of shipbuilding industrial zones and encouraged local industries, as well as foreign investors, to participate. More detail is given in Tables 3 and 4.

Table 3. **Economic zones in Viet Nam that include shipbuilding facilities**

Nhon Hoi economic zone shipbuilding project	Vinashin is planning to construct and repair 10 000 dwt vessels in the first phase, and 100 000 dwt vessels after the second phase in Nhon Hoi economic zone. This project is a part of the Vietnamese shipbuilding development programme.
Dung Quat economic zone shipbuilding project	This economic zone is located in the central province of Quang Ngai. One of the major projects in this zone is Dung Quat shipbuilding complex estimated to cost over USD 700 million.
Van Phong economic zone shipbuilding project	In this economic zone, STX Shipbuilding Ltd of South Korea, is expected to build a shipyard with an annual capacity of between 900 000 and 2.5 million dwt covering 300 hectares.
Nghi Son economic zone shipbuilding project	This economic zone is located in the north-central region in Thanh Hoa province. Its establishment is expected to enhance the development of this north-central region of Viet Nam, and will include a shipyard capable of building 50 000 dwt vessels. It will also contain high-end steel and construction materials industries.
Thinh Long Industrial Zone	Vinashin is also ready to spend some USD 40 million to build Thinh Long Shipyard in Thinh Long Industrial Zone. The new shipyard will be able to construct and repair vessels of 15 000 – 30 000 dwt.

Source: Compiled by the OECD Secretariat.

Table 4. **Shipbuilding-related industrial parks in Viet Nam**

Xoai Rap shipbuilding industrial park (IP)	This new IP is located in Tien Giang province with an area of 485 hectares. The Tien Giang provincial People's Committee has already allocated 246 hectares of land to the Vinashin for investment projects in the first phase. In 2007, Vinashin plans to construct a shipbuilding plant in the Xoai Rap IP employing more than 10 000 workers. Also, the Wonil Group of Korea was registered to rent 100–200 hectares of land in the IP to produce equipment and machinery for the shipbuilding industry. The Korean group plans to invest USD 300 million for a shipbuilding plant, and will recruit 5 000 workers.
Soai Rap industrial park	This IP is located in Tien Giang province and has plans for a shipbuilding complex with sub-contractors and a special purpose port.
An Hong industrial park	This IP is located in Haiphong and has plans for marine engine assembly up to 6 000 HP, production of anchors, electrical equipment, accommodation equipment, boilers, navigation equipment, and containers.
Lai Vu industrial park	This IP is located in Hai Duong province (220 ha) and has plans for a 300 000 TEU capacity container factory, outfitting manufacturing, heavy industries, 2-stroke engine factory and technical training centre.
Cai Lan industrial park	This IP is located in Quang Ninh province (56.4 ha) and has plans for a steel plate mill of 500 000 tons/year, 40 MW power plant, steel structure factory and port terminal.

Source: Danish export association, 2006.

Workforce (including training and education)

Viet Nam has a population of around 83 million, of which the majority (around 75%) live in rural areas and is under the age of thirty. The workforce totals about 59 million, of which between 10 and 45% are unemployed or underemployed. The average income is around USD 500 per year. It is estimated that 1–1.5 million new people join the workforce each year (NORAD, 2003). Strong industrial growth and expanding foreign investment is generating a demand for a variety of work skills that are currently in short supply. Creating a better-trained workforce will be a key pillar to Viet Nam sustaining long-term economic growth and developing an internationally competitive workforce. To this end, over the last few years the Vietnamese government has increased budget allocations, liberalised private sector involvement and has encouraged foreign participation to develop education and training services in Viet Nam.

The government has developed a long-term Education Development Strategy for 2001 to 2010, and estimates that education expenditure could increase to 6.9% of GDP and 20% of total government expenditure by 2010 (US Commercial Service 2005). Viet Nam has also increased enrolments in education; primary enrolments are very nearly universal and secondary enrolments have risen to over 65%. The potential for future growth in agriculture is limited, therefore creating employment in sectors like shipbuilding that are outside of agriculture and the traditional informal segments, is a core challenge for the government.

As an example, in 2000, the Nam Trieu shipyard in the northern Vietnamese port of Haiphong was a small shipbuilder with 321 workers and construction capability of small vessels of up to 13,000 dwt. Today it is a multi-sector corporation with a total of 12 000 employees (ABS, 2007). By 2012, total group employment is expected to reach 35 000.

At present, the abundant low-cost labour force is a clear strength for the shipbuilding industry in Viet Nam, where labour costs are very competitive compared to international levels, as the monthly salary for an average worker is about VND 950 000 (about USD 60). In comparison, the average cost of skilled labour in Korea is 15-20 times higher, and

2–3 times higher in China (BLP, 2005). When allowances, social security, overtime and other costs are figured in, the average cost per worker to the employer is between USD 90 and USD 110 a month in Viet Nam, whereas in the Dongguan region of southern China it is in the USD 160 to USD 190 range.[16]

The changes in the size and structure of the shipbuilding industry, and the introduction of new technologies and products, necessitate an enhancement of the normal levels of recruitment and related training requirements for all categories of personnel. In Viet Nam, the training and education of the shipyard workforce engaged in production, management and design activities require special attention because skill levels are generally low, due to the cost of training and the large number of workers rapidly inducted into the shipbuilding workforce in order to cope with increasing demand. Even though Viet Nam has an ample and youthful workforce, only 27% of workers have received vocational training, and skilled labour shortages hinder Viet Nam's industrial capacity.

Despite its attractions, labour in Viet Nam poses some problems for foreign investors. There is a shortage of managerial talent and skilled workers, resulting in higher salaries and very high turnover of those with skills, as those employees seek out ever more lucrative opportunities. Another factor raising the cost of skilled and managerial workers is Viet Nam's progressive personal income tax system that results in labour costs being two to three times higher than in other Asian countries for relatively high-paid local staff. This difficulty was addressed by a legislative amendment in 2004.[17]

FDI enterprises organise short-term vocational training courses, or re-train their workers on-site, to meet their immediate requirements. Sometimes FDI enterprises have to retrain around 30% of their workers, and even send workers who work at key stages of the production lines abroad for training.[18] Vietnamese labour does not consider FDI enterprises only as a source of higher wages, but also as a means of acquiring new knowledge and skills, and to learn new working techniques.

From a domestic perspective, the staff building programmes of Nam Trieu Shipbuilding Industry Company (Nasico) include training of its staff at foreign shipyards in Europe and Japan, as well as special courses on international regulations and procedures for quality control inspectors (ABS, 2007).

More generally, due to the high demand for workers in the industry sector and to improve rural income, the Tien Giang province has been working with Ho Chi Minh City to organise job training courses to encourage farmers to shift from agriculture to industrial production. In addition, the Ben Tre province is seeking to open 60 private vocational training schools, and encourage 1 000 companies to take part in job training, in order to supply at least 70% of the workforce for the province through 2010.[19]

Specialisation into particular vessel types

Viet Nam aims to develop the capability to build various kinds of ships through technology transfer and joint ventures. Its newbuilding orderbook has substantially increased recently with new orders of Aframax, VLCC tankers, FSO vessels and LPG carriers, and Viet Nam is also aiming to build a solid platform in the Ro-Pax market. Joint ventures provide a quick, inexpensive way to close the gap between Viet Nam and the established market, both in terms of technology and structure. Viet Nam still needs a certain amount of time to establish its reputation, which is very important if it is to bid for

sophisticated vessels, because this sector has high expectations with respect to the technological sophistication and high quality of the end products.

An example of Viet Nam's advances in this market was the 54 000 dwt Handymax sisters Graiglas and Florence, which were handed over simultaneously by the Nam Trieu and Ha Long shipyards, in the northern part of Viet Nam, which are series-building the Diamond 53 class to diversified export accounts. Construction is now also in progress of the first vessel from Viet Nam to top 100 000 dwt, which will provide a new reference point for the industry.

Vinashin's Dung Quat Shipyard is to deliver three 105 000 dwt Aframax tankers in 2010, the first of which is being built to the account of Vinashin's own shipowning interests. The second and third tankers have been contracted by PetroVietnam, which is also set to steer the industry into the very large crude carrier field, having signed letters of intent for two 300 000 dwt-plus tankers, with further options.

Another initiative which is giving added dimension to Viet Nam's production and technical capability is the long-term strategic agreement entered into with Höegh Autoliners in the field of deep sea pure car carriers. The first output of this co-operation will be state-of-the-art vessels of 6 900 car equivalent unit capacity. External input into this co-operative arrangement is likely to be considerable since the agreement provides for technology transfers and includes the participation of the classification society Det Norske Veritas, as well as the Finnish technical marine and ship design consultancy Deltamarin. Vinashin's breakthrough in the car carrier market was highlighted by a contract in 2006 with Ray Car Carriers, entailing eight vessels each with a capacity 4 900 units.

Aker Yards is also to enter into a joint venture with the Singapore company Amanda Group to create a new shipyard at Vung Tau that will specialise in offshore support vessels. Aker will own 70% of the new undertaking and intends to invest USD 16 million into the development over a period of three years. The yard is ultimately expected to have an output capacity of three or four newbuilds a year. The first project involves a series of six anchor-handlers, incorporating the Aker AH08 design and contracted through Aker Capital, for the Asian offshore market.

Under a joint venture agreement between Damen Shipyards of the Netherlands and Vinashin, a new yard is to be created in the Haiphong area to target more specialised tonnage in the under-10 000 dwt range. Damen Vinashin Shipyard will apply the Dutch partner's particular expertise in fields such as tugs, offshore vessels and workboats, high-speed craft and small cargo ships (Lloyd's List, 2007).

Access to, and development of, technology

A competitive shipbuilding industry cannot simply depend on low labour cost, as this is an unsophisticated and often fleeting competitive advantage. Experience around the world has shown that yards also need to adopt new technologies in order to improve productivity and retain their competitive edge. Viet Nam appears to have recognised this, and the transfer of technology in order to improve efficiency, technical capability and productivity is one of the more common co-operative arrangements between Vietnamese shipyards and foreign partners. In particular, the Vietnamese government promotes co-operation with foreign partners such as Poland, Germany, Norway and Japan in order to encourage knowledge transfer on ship design and new technologies.

At present, the local content (labour, secondary materials and some minor equipment) in the shipbuilding sector is just 30-35%, while engines and other main items of equipment are imported. Vinashin hopes to increase the local content ratio by building a factory to assemble diesel engines of up to 32 000 hp in Hai Phong, and to establish new plants to manufacture welding rods and other items for vessels. The company will also set up two shipbuilding centres in Saigon and CanTho to assemble diesel engines, gear box anchor linkage, boilers.

Vinashin has signed contracts with Polish shipbuilders for the transfer of modern shipbuilding technologies worth around USD 200 million (Borgersen, 2004) and also plans to invest between USD 1.5 billion and USD 2 billion for the construction of high-speed vessels with a capacity of 2 000 passengers for the north-south route of country; with the first vessel being constructed by a foreign shipyard, while others would be built in Viet Nam.

The Viet Nam Chamber of Commerce and Industry (VCCI) is in close co-operation with Vietnamese and Dutch maritime enterprises in marine equipment areas such as in fire-proof and water-resistant materials for cables, pipes, propellers, and freezing equipment for the shipbuilding industry.

The role of marine institutions

The Viet Nam Register (VR) is a non-profit State Body that provides technical supervision and certification related to the application of Quality and Safety standards to most major transportation modes, including ships and offshore installations. It was established in 1964 and issued its first Rules and Regulations for Classification and Construction of Steel Sea-Going Ships in 1970. It is headquartered in Hanoi and maintains 26 offices and sub-offices nationwide that provide ship and offshore classification and certification services. VR has signed bilateral classification agreements with all ten members and the associate member of the International Association of Classification Societies (IACS) and with prominent non-IACS societies. These agreements authorise foreign class surveyors to perform surveys on behalf of VR outside Viet Nam and for VR to perform work on their behalf inside Viet Nam.

VR began its first work with vessels above 15 000 dwt in 2005, when it undertook the classification of a series of 20 000 dwt bulk carriers designed in Viet Nam. Today, VR is engaged in surveying the new construction of a series of 53 000 dwt bulk carriers and 104 000 dwt oil tankers as well as the construction of a 150 000 dwt floating storage and offloading (FSO) unit.

The American Bureau of Shipping (ABS) recently signed an expanded agreement of co-operation with VR covering the provision of a wide range of classification and statutory services.[20] The VR's main area of focus was on smaller ships and some offshore installations, but the changing nature of Viet Nam's shipbuilding industry means that VR must now expand its horizons and capabilities. Bureau Veritas (BV) has also signed an agreement with VR covering training and development of VR surveyors, who will work through BV's structured training programme and work on secondment with BV.

Det Norske Veritas (DNV) is one of the most important classification societies for Viet Nam's expanding shipbuilding industry, accounting for approximately 70% of the country's orderbook, and with VR has jointly developed a three-year training program for all Vinashin shipyard staff. With the support of Norad (Norwegian Agency for

Development Co-operation) more than 1 200 people each year will be trained in different aspects of shipbuilding.[21]

As a result of significant support from Germanischer Lloyd (GL), Vietnamese employees were trained directly at the Peene yard design office in Wolgast, Germany. Furthermore, MPC[22] Marine has sent permanent staff members to the Nasico yard in Haiphong to train local workers (GL, 2008).

The role of minor yards and off-shore structures, ship conversion capability

Vinashin has capabilities in the repair, conversion and modification of all double hull ship sizes up to VLCC. Its services include floating and dock repair, oil rig repair and car carrier elongation. Repairs are largely carried out at Bach Dang, Pha Rung, Hyundai-Vinashin (HSV) and Saigon Shipyards (Vinashin Business Group 2006).

The ministry of Transport operates some small shipyards (capable of building vessels up to 800 dwt) which service inland river transport needs. There are also small yards operated by the Ministry of Fisheries which mainly build wooden fishing boats. Furthermore, the Peoples' Committees of some coastal cities and provinces possess some small shipyards, which mainly serve the domestic market for small ships.

The role of the marine equipment industry

Today, shipyards are flexible enterprises which are tied together in value added chains with external suppliers – such as their service partners and marine suppliers/equipment manufacturers. Formerly integrated shipyards, which covered the whole production process of a ship, are no longer the standard model. On average 1/3 of the added value of a ship is produced by the shipyard itself, while 2/3 are produced by other suppliers.

Therefore Vinashin has licence and co-production agreements for marine equipment with a number of manufacturers,[23] and is also planning to construct new facilities that will focus on manufacturing auxiliary equipment. These agreements help Viet Nam to modernise its shipbuilding industry, raise the local participation rate and considerably trim costs compared to imported equipment and machinery. They also create conditions for the Vietnamese shipbuilding workforce to approach and apply modern technology and to produce equipment suitable for export markets.

The Vietnamese domestic mechanical industry represents 13% of its industrial output, most of it for domestic use. Engines below 30 HP are manufactured entirely in Viet Nam as well as some pumps and air conditioners.

The Hai Duong industrial park (where the cost of all infrastructure and buildings is carried by Vinashin) has a marine equipment factory with an area of 9 800 m^2 and can produce marine engines, generators, steering gear and propeller shaft system, cranes and windlasses, valves, pumps and fans. Equipment suppliers can first start by assembling components, and then manufacture the products for both domestic and export markets.

Vinashin Control System and Communication (Vinacom) is a subsidiary of Vinashin that has the capability of manufacturing marine equipment such as automation technology monitoring and control system, shipboard cables, GMDSS equipment and air conditioning and safety emergency systems, although some of these depend on foreign partnerships.

Nam Trieu Shipbuilding Industry Company (Nasico) has invested in a number of projects aimed at diversifying auxiliary sectors associated with the shipbuilding industry. One of the group's most successful enterprises is the Nam Trieu Welding Materials Company (Nawelco), a manufacturer of welding electrodes and solid and flux-core welding wire. Nasico's objective is to increase the use of domestically produced marine equipment and materials, such as hatch covers, marine and hoisting equipment and steel wire. Nasico also operates a hot-rolled steel plant that produces steel plate for the construction of new vessels. In the future Nasisco is planning to shorten the shipbuilding cycle, increase its technological capability, raise product quality and update the preparation and organisation of production.

Some marine equipment companies that are active in Viet Nam are:

- Denmark's MAN B&W Diesel A/S, supplier of large diesel engines for ship propulsion systems, stationary power supply and rail traction, signed a contract on transferring ship manufacturing and assembling technology with the Bach Dang shipyard of Vinashin for the main engines up to 32 000 HP.
- Mitsubishi Heavy Industries, Ltd. (MHI) signed an agreement in 2005 for the licensing of its low-speed diesel engine technology to Vinashin. The contract applies specifically to the Mitsubishi UEC-LA, LS, LSII and LSE engines, and the licensing agreement also encompasses marketing and servicing of these engines in Viet Nam. The period of licensing is from 2005 to 2014.24
- Vinashin and Wartsila Switzerland Ltd, a subsidiary of Wartsila Corporation, jointly signed a licence agreement for the manufacture and sale of low-speed marine diesel engines in Viet Nam. The agreement grants Vinashin the right to manufacture certain types of modern low-speed engine types at their works in Viet Nam. The first delivery of a Wartsila engine is scheduled for 2010, with production building up to a targeted annual output of 30 to 40 engines per year. This licence agreement provides the growing Vietnamese shipbuilding industry with the latest technology for low-speed diesel engines, including the most modern electronically controlled common-rail technology. Prior to this licence agreement, Wärtsilä low-speed engines had already been ordered by Vinashin for import from Japan and Poland.
- The German firm Thyssen-Krupp AG established a representative office in Viet Nam in 1995, and since then the Group has been actively operating in steel, elevator technologies and services and supplying equipment to the shipbuilding industry, as well as insulation and corrosion protection materials to the oil and gas industry.
- A joint venture to manufacture maritime equipment will be set up in the northern city of Hai Phong under a contract signed in March 2007 between Vinashin and Finland's Macgregor Group. The new joint venture has been licensed to begin operating in the Vinashin-Shinec industrial zone in the northern port city of Haiphong and will concentrate on hatch cover production to service shipyards within Viet Nam. The next phase will include the production and assembly of ship cranes as well as the production of RoRo equipment.
- A joint-venture established in 2005 between Danish Aalborg Industries and Vinashin is manufacturing high quality marine boilers for Vietnamese shipyards, as well as other shipyards in Asia. Aalborg Industries also supplies waste heat

recovery boilers, thermal fluid heaters, burners, heat exchangers and inert gas systems.

Principal construction facilities

Construction/production capabilities

The Vietnamese government aims to have a new shipbuilding capacity of 3 million dwt by 2010, and expansion works have been going on in many shipyards. Tables 5, 6 and 7 show the construction capabilities and activities of the main yards.

Table 5. **New building and repair activities in main south cluster shipyards**

Name of shipyard	Construction/Production capabilities
Saigon shipyard	While in the past the company could only build boats, catamarans and sailing yachts with a capacity around 1 000 dwt for inland transportation, it is now capable of building 6 500 dwt vessels. The yard is to build ten general cargo ships ordered by Midland Shipping of Canada, each of 5 190 dwt, for delivery by 2009. These are intended for river and sea operations Vinashin is planning to upgrade this shipyard for newbuilding and repairing vessels up to 22 500 dwt.
Hoang Anh shipbuilding industry company	This yard was developed from a small shipyard and the company became a member of Vinashin in May 2003. It has the ability to build up to ten vessels of 2 500–3 000 dwt a year.
Aker yards – Viet Nam	This new yard will deliver its first AHTS (Anchor Handling Tug Supply) vessel in 2010 and currently has 6 x 4 000 dwt AHTS in its orderbook.

Source: Compiled by the OECD Secretariat.

Table 6. **New building and repair activities in main center cluster shipyards**

Name of shipyard	Construction/Production capabilities
Dung Quat shipyard	Vinashin is the sole investor and will eventually be one of the largest shipyards in South East Asia and located in Dung Quat economic zone. The yard is constructed to build vessels up to VLCC in docks of 520 m x 110 m and 380 m x 86 m with 3 000 m. of quayside. It will also be the builder of Petrovietnam's two new 104 000 dwt Aframax and VLCC tankers.
Hyundai-Vinashin shipyard	This yard is a joint venture between Vinashin (with 30% ownership) and the Korean Hyundai Mipo Dockyard. It was originally built as a repair yard for vessels up to 400 000 dwt but has been upgraded and is now also capable of offshore structures.
Nha Trang shipbuilding industry company (Nha Trang SICO)	This yard is to build 12 cargo freighters of 20 000–36 000 dwt and three 250-TEU container carriers with a total value of USD 462 million for Vinashin Petroleum Investment, Transport Joint Stock Company, Vinashin Ocean Shipping Company and Southern Industrial Development Company. These four companies are the members of Vinashin Business Group and the first ship will be handed over by 2009 and the order to be completed by 2011.
Danang shipyard	This yard is capable of constructing cargo freighters of 20 000 dwt and repairing ships of 30 000 dwt, and is also equipped with advanced shipbuilding technologies. It has an initial investment capital of around USD 38 million.
Phu Yen shipyard	This shipyard is currently building eight barges of 200 dwt for a domestic company and four fishing vessels of 600 hp each for ASEAN clients. Upon completion of the second phase it will be able to construct fishing vessels of 1 000 hp and cargo ships of 3 000 dwt.

Source: Compiled by the OECD Secretariat.

Table 7. **New building and repair activities in main north cluster shipyards**

Name of shipyard	Construction/Production capabilities
Ha Long shipyard	This yard is one of those selected to build eight of the 53 000 dwt bulk carriers for Graig Investment. It is also the builder of 1 700 TEU and 3 200 TEU container vessels for Vinalines and a series of 12 000 dwt freighters for Vietnamese customers. This was founded in 1976 with assistance from Poland, with which it maintains an historical connection, and it mainly uses Polish equipment. Expansion plans at the shipyard are already underway with a new slipway and dry dock under construction, with plans to increase its workforce from 3 000 to 5 000 over the next three years.
Bach Dang shipyard	This shipyard is capable of building about eight ships at the same time of around 20 000 dwt each. In 2006, it built a 13 500 dwt oil tanker, and two handysize dry cargo vessels for Japan. It also delivered a 610 TEU container ship to the Bien Dong Transport Company. Bach Dang yard has begun manufacturing Mitsubishi marine engines in the 8 400 to 32 000 hp range.
Nam Trieu shipbuilding industry company	This yard has been tasked by Vinashin to build seven of the 53 000 dwt vessels for the Graig as well as general cargo vessels for Vinalines. Nam Trieu company will build eight 6 900 units car carriers for Hoegh Autoliner (Norway). Also, Vinashin started construction on the country's biggest 150 000 dwt floating storage offloading (FSO) vessel that will be a key component in the development of Viet Nam's offshore oil reserves for PetroVietnam in this yard. The FSO is scheduled for construction on a specially outfitted slipway over 18 months.
Pha Rung ship repair yard	In 2003-4, an important landmark was seen in the development of Pha Rung Ship Repair Factory (Pha Rung Shipbuilding Company today), when the factory began to build vessels instead of just repairing them. Vinashin has allowed Pha Rung Ship Repair Yard to upgrade and expand its factory for the repair of 16 000 dwt vessels and construction of 35 000- 40 000 DWT vessels. The Pha Rung yard will construct some bulk carrier vessels of 34 000 dwt for Graig Investments of the UK and chemical tankers of 6 500 dwt and 13 000 dwt.
Song Gia shipyard	Pha Rung Shipbuilding Company has started on the construction of the most advanced shipyard in Viet Nam to date, costing nearly USD 312.5 million. To be completed by late 2007, Song Gia shipyard will be capable of building 26 oceangoing ships a year, with capacities ranging between 50 000 dwt and 70 000 dwt.
Nghi Son shipyard	In its current configuration this yard is able to build and repair oceangoing ships of over 50 000 dwt. In the second phase (2010) the Nghi Son Shipyard will be upgraded through the expenditure of USD 57 million to double its capacity to 100 000 dwt.
Ben Kien shipyard	This yard delivered 8 700 dwt cargo ships to the Japanese Kanematsu Corporation and is building ten 4 600 dwt MPP vessels for Denmark's Clipper Group and 14 000 dwt cement vessels for a Norwegian ship owner.

Source: Compiled by the OECD secretariat.

Industry performance

Types of vessels built and production record

- The main vessel types in the portfolio of Vietnamese yards are as shown below:
- Bulk carrier vessel (handysize/handymax)
- Crude oil tanker (aframax/vlcc)
- Container vessel (up to 1 016 TEU)
- General cargo vessel (up to 12 500 dwt)
- LPG vessel (up to 7 200 cbm/6 500 dwt)

- Chemical/Oil products tanker (up to 13 000 dwt)
- Multi purpose (MPP) container vessels (up to 15 000 dwt)
- Pure Car Carrier (PCC) vessel (up to 6 900 unit/27 000 dwt)
- Floating storage and offloading (FSO) vessel (up to 150 000 dwt)
- Anchor handling tug supply (AHTS) vessel (up to 4 000 dwt)
- Others:
  - Dredgers (max. 1 500 m3/h)
  - Passenger boats (about 100 seats)
  - Fishing boats (max. 600 cv)
  - High-speed boats (max. 30 miles/h)
  - Tugboats, barges, yachts, rescue ships/boats

The world output of new vessels in 2007 was 34.7 m cgt,[25] of which Viet Nam delivered 0.76m cgt. This is 0.68 m cgt more than its 2006 output (see Table 8) (LR, 2007).

Table 8. **The total completions of Vietnamese yards – cgt (million)**

Year	2002	2003	2004	2005	2006	2007
cgt (million)	0.02	0.04	0.04	0.07	0.08	0.76
World share (%)	0.10	0.18	0.16	0.27	0.26	2.19

Source: Clarkson research services / Lloyd`s Register-Fairplay (2007).

In general, Vietnamese yards produce smaller tonnage vessels such as tankers, bulkers and multipurpose (MPP) vessels. However, Viet Nam's newbuilding orderbook increased recently with new orders of Aframax and VLCC tankers, as shown in Table 9.

The expansion of Viet Nam's shipbuilding is similar to that of China and South Korea, in that the growth has been heavily dependent upon the export market, whereas in earlier times the UK and Japan based their initial expansion programmes upon the domestic fleet. Around 60% of Vinashin's production is destined for export, with Graig Investment Ltd. (UK), Ray Shipping (Israel), Clipper (Denmark), NOMA Shipping Lines (Japan), Kanematsu (Japan), Fortune Marine (S.Korea) and Damen Shipyard (Holland) its key customers (Vinashin Business Group, 2006).

Table 9. **Domestic/export mix of Vietnamese yards orderbook**

Type of vessel	Export vessels no.	Export cgt	Domestic vessels no.	Domestic cgt
Bulk carriers	54	793 234	7	103 334
Crude oil tankers	-	-	5	129 797
Container vessels	10	78 504	3	42 567
General cargo vessels	51	271 864	36	153 975
Vehicles carriers	12	346 296	-	-
Chemical/Oil products tankers	9	84 470	3	43 475
LPG vessels	4	29 596	-	-
Total	140	1 603 964	54	473 148

Source: Lloyd's Register-Fairplay (2007).

Analysis of order books

The world newbuilding orderbook grew to 488.5 million dwt (Table 10) as of the beginning of 2008, a significant increase on earlier years. Table 10 also shows the types of vessels in that orderbook.

Table 10. **World newbuilding orderbook (1998 /January 2008 - million DWT)**

ORDER BOOK
Mill. dwt

Start	Tankers	Chemical carriers	Bulk carriers	Combined carriers	Others	Total
1998	30.4	11.3	26.4	0.4	14.5	83.0
1999	34.3	11.1	25.5	0.4	13.7	85.0
2000	24.8	10.4	30.5	-	15.5	81.2
2001	39.3	9.5	34.3	0.2	24.5	107.8
2002	52.0	10.0	22.4	0.2	27.9	112.5
2003	45.3	10.8	30.3	0.2	22.9	109.5
2004	65.1	10.2	48.4	-	41.2	164.8
2005	72.0	11.6	60.6	-	56.2	200.4
2006	76.5	3.3	61.4	-	68.1	209.3
2007	128.7	11.0	78.9	-	80.0	298.6
2008	**147.7**	**19.0**	**216.1**	-	**105.7**	**488.5**

Source: Platou (2008), *The Platou Report 2008*, R.S. Platou Economic Research A.S.

In terms of Compensated Gross Tonnes (cgt)[26] (see Table 11) South Korea held the largest orderbook with 63.4 million cgt, (35.7% of the world total), followed by China with 50.2 million cgt 28.2%) and Japan with 30.7 million cgt (17.3 %). Viet Nam has recently begun to make its presence felt in international shipbuilding, with its growth based on the availability of very cheap labour. Its emergence started gradually in July 1999, with contracts averaging just 0.02 million cgt a year until 2002. It was only after 2002 that the Vietnamese shipbuilding started to increase rapidly. By December 2007, the Vietnamese orderbook stands at 2.2 million cgt (around 4.8 million dwt) and was the 8th largest in the world as of December 2007, suggesting that this is still growing (WSM, 2007).

Table 11. **Total world new-building orderbook – December 2007**

Country of building	No	gt (000s)	cgt (000s)
South Korea	2,242	126,530	63,388
China	3,139	97,761	50,216
Japan	1,495	63,814	30,714
Germany	203	4,165	3,775
Italy	118	2,570	2,945
Philippines	116	5,160	2,489
Turkey	337	2,348	2,341
Viet Nam	206	3,203	2,143
Romania	146	3,043	2,121
India	246	2,615	2,030
Chinese Taipei	67	2,838	1,683
Poland	122	2,031	1,673
Croatia	69	1,997	1,201
Denmark	23	1,462	0.662
Rest of the World	1,527	10,190	10,320
Total	10,055	329,731	177,740

Source: Lloyd's Register-Fairplay (2007).

In keeping with experience in other economies, Vietnamese shipbuilders have a strong orderbook, which may sustain its industry for some years. On the basis of this strong backlog the Vietnamese shipbuilding industry has been improving its quality and its share of sophisticated vessels and high value-added ships such as PCC and FSO vessels. In terms of dwt, the Vietnamese orderbook was 4.4 million dwt at the end of 2007, which compares very favourably with its position at the end of 2003, when it only held orders totalling 150 000 dwt. Table 12 provides details by vessel type of that orderbook, which covers 194 vessels, of which around 70% are for foreign owners.

Table 12. **The orderbook of Vietnamese yards**

Type of vessel	No.	gt	cgt	dwt
Bulk carrier	61	1 676 865	896 568	2 832 802
Crude oil tanker	5	312 000	129 797	535 000
Container vessel	13	120 796	121 071	153 400
General cargo vessel	87	321 536	425 839	469 877
Vehicles carrier	12	592 000	346 296	165 600
Chemical/Oil products tankers	12	131 994	127 945	210 900
LPG vessels	4	17 600	29 596	19 840
Total	194	3 172 791	2 077 112	4 387 419

Source: Lloyd's Register-Fairplay (2007).

Financial performance of yards

Vinashin's revenue has grown significantly in recent years, boosted by a steady inflow of orders. This growth reflects its growing stature in the global market and has been facilitated by its significant investments, its many joint ventures and the inflow of technical assistance. In 2006, the government announced a plan to restructure Vinashin as a multiple-owner business organisation with the state holding a majority stake. It was envisaged that the organisation would be comprised of state-owned enterprises, joint stock companies and foreign joint ventures and would provide the framework for any

future investment in new companies. The ultimate aim of the initiative was to increase financial performance of yards and sharpen competitiveness in the world market. (Lloyd's List 2007)

Vinashin reported revenues of nearly VND 11 700 billion (USD 731.25 million) in 2006, which was 47.9% higher compared to the previous year. In 2007, it was targeting revenues of VND 18 500 billion (USD 1.16 billion) (see Table 13).

Table 13. **Vinashin Revenues (in billions VND)**

Year	2000	2001	2002	2003	2004	2005	2006	2007
Revenues	1 010	1 303	2 515	3 173	5 560	7 708	11 500	18 500(est)

Source: Vinashin Business Group (2006).

The turnover of Hyundai-Vinashin Co. Ltd (HVS) in 2006 was ten times that of 1999, and increased on average by 37% annually. More than 80% of the company's turnover was from foreign clients. In 2007, HVS was targeting revenues of USD 144.5 million, an increase of 10.1% compared to 2006.

Productivity and competitiveness

Increasing productivity is one way to keep costs down. In the broadest sense, the shipbuilding industry increases productivity by incorporating process enhancements or through modernisation, or by a combination of both. Process improvements include any changes that affect employee training, quality control and manufacturing flow. Since shipbuilding involves a complex production process, the level of efficiency (and therefore costs) can vary considerably from one yard to another.

Material cost and availability are significant factors, and major shipbuilding economies can support a very wide range of material and equipment suppliers. Shipyards in areas with little shipbuilding activity have a more difficult time, and so one of Vinashin's objectives is to cover 60-70% of the cost of construction of a newbuilding with domestic material and equipment (BLP 2005). Heavy investments are envisaged, including steel works able to manufacture steel plates for ships, in order to achieve that target.

Although attention often focuses on the shipyard facilities as the main determinant of competitiveness, in reality there are many factors, such as material supply, facilities, skilled labour, wages, labour productivity, exchange rates and subsidies that play a part in determining how many ships are produced, how much they cost and the revenue received by the shipbuilder. Shipbuilders in countries that have access to cheap resources can be competitive in the low value-added shipbuilding market. At present Viet Nam has the potential to capture a considerable market share of low value-added ships because of the low cost of inputs such as labour and land.

However, the competitiveness of the Vietnamese shipbuilding industry would be tested if a slowdown in world demand for newbuildings were to coincide with the bringing on-line of significant new shipbuilding capacity in Viet Nam and other shipbuilding centres.

Signals from the market are that worldwide shipbuilding capacity has been increasing significantly in response to the buoyant market. For example, according to data from the

China Association of the National Shipbuilding Industry (CANSI)[27] shipbuilding capacity in that economy will exceed 40 million dwt a year in 2010, if new yards planned by investors are completed. In addition, the total world shipbuilding capacity is expected to reach 115 million dwt by that time. If this eventuates it can be speculated that competition from emerging low-cost shipbuilding nations such as Viet Nam and China will force the EU, Japan and Korean shipyards to become even more efficient and technologically sophisticated in order to stay ahead of their competitors.

Very high capacity and declining demand will also generate strong competition amongst the new entrants in the shipbuilding industry for available orders in their specific market niches, and here Viet Nam will be in direct competition with China, India, the Philippines and other emerging shipbuilding economies. It remains to be seen whether the nascent Vietnamese shipbuilding sector will be sufficiently flexible and competitive to continue to carve out a growing international as well as domestic market share.

Recent growth in Vietnamese shipbuilding

Investment

WTO membership is expected to have positive effects on inward foreign investment in Viet Nam because it strengthens the economy's openness and expands the market size. In general, economies open to trade are attractive to foreign investors for two main reasons: the openness signals that the government has policies in place that welcome both trade and (by implication) competition, and it helps reassure investors that they can repatriate their profits. By joining the world trade bodies, Viet Nam not only commits itself to further reforms but also aligns its rules and regulations with international standards and practices. Foreign investors now generally enjoy equal footing with their domestic counterparts in the legal environment, while trade-related restrictions on investment have been removed. With lower tariff barriers, the cost of doing business in Viet Nam will be lower than it used to be, which will help boost the competitiveness of local production (MFA, 2006).

Vinashin continues to make significant investments in its shipbuilding sector in order to speed its development and some information on recent new shipyard projects in Viet Nam is given below:

- Cam Ranh yard is located in the central Khanh Hoa coastal province and is being constructed by Nha Trang SICO with around USD 200 million being invested in a two phase project. It will be capable of building large passenger ships and cargo freighters of 50 000 dwt and provide jobs for 4 000 people.
- The Ca Mau Shipbuilding Industry has started the construction of a shipyard in order to build vessels of 30 000 dwt for export purpose in Ca Mau Province in March 2007. The dockyard is scheduled for operation in 2008 and will employ around 3 000 workers.
- The construction of Binh Dinh shipyard is to start in 2007. Modern technology will be applied so that the shipyard will be capable of building 50 000 dwt ships and repairing 100 000 dwt ships. It will employ 2 000 workers when the first stage is completed.

- The Thnh Long (includes Thinh Long 1 and Thinh Long 2) shipbuilding complex will be the biggest project of Vinashin in Nam Dinh. The construction of a 193-hectare complex will cost an estimated USD 100 million, with a capacity for 15 000-30 000 dwt vessels. It will also include factories manufacturing rolled-steel, ship components and cranes.
- The Song Hong shipyard has an investment of 16.5 million USD covering 10.4 hectares in Hanoi and is funded by the State budget and commercial loans in the first phase. Once operational in January 2008, the shipyard will be capable of building 2 000 dwt cargo and 250-seat passenger ships. The second phase of the project is expected to be completed in 2010, capable of constructing 6 500 cargo vessels

Future plans

Green-field developments and modernisation/expansion plans

Vinashin has established a new subsidiary – Vinashin Offshore Industries (Vinaoffshore) in Ha Noi – which will focus on manufacturing floating storage and off-loading (FSO) units, single print moorings, oil drilling vessels and other heavy equipment.[28] The group is also set to move into the very large crude carrier business with letters of intent signed with domestic and international ship owners for up to eight tankers worth more than USD 800 million.

Vinashin plans to turn the Nam Trieu shipyard into an industrial complex in two phases. The first phase, lasting from 2000 to 2006, was focused particularly on building slipways capable of constructing vessels up to 100 000 dwt. The second phase, up to the year 2012, includes the construction of a new shipyard that will be capable of building vessels of up to 350 000 dwt in the Tien Lang district of the Haiphong.

In future, the share of sophisticated vessels in the Vietnamese orderbook is expected to increase as a result of recent developments, such as the investments made by Aker Yards and co-operation with Hoegh Autoliners. Also, Damen Vinashin Shipyard is expected to focus on special type vessels such as tugs, offshore vessels and high-speed craft, creating new export opportunities.

Summary and conclusions

Viet Nam is one of the fastest growing economies in Asia, recording an average GDP growth of about 7.5% over the last decade, and 8.3% in 2007. With its accession to the WTO in January 2007, Viet Nam entered a new phase of development, characterised by deeper integration into the global economy, with its associated opportunities and challenges. The outlook in the medium term is also positive, with the economy predicted to grow by 8.5% in 2008, and prospects for the economy are predicated on the assumption that Viet Nam will maintain the momentum of structural reforms. The strong demand for new vessels over the last few years has also stimulated the interest of newly industrialising economies, like Viet Nam, in shipbuilding. The shipbuilding industry produces considerable demand for many other associated industry products, and it also makes useful contributions to related industries such as steel assembly, welding technology, system design and so on.

Shipbuilding has been, and continues to be, an important and strategic industry for many economies. Japan used shipbuilding to rebuild its industrial structure after World War II, while Korea made shipbuilding a strategic industry in the 1970s. China is now following Japan and Korea with large state-supported investments in the industry, and has plans to become the world's largest shipbuilding nation by 2015. These developments highlight the enormous role that shipbuilding can play in developing national economies. Viet Nam, largely through the conglomerate Vinashin, has made significant investments in its shipbuilding infrastructure and is actively seeking partners to speed its development. The benefits offered to a shipbuilding partner include competitive prices, greater control over the vessel's design and a valuable role in a growing market for new buildings.

Viet Nam has low wage levels and a high literacy rate. The political situation is stable and the government intends to push economic development. Investors are being given favourable conditions and the country has an advantageous geographical location in Southeast Asia.

The modern trend is for yards to seek partnerships with foreign yards, or to take over facilities outside their domestic region in order to become and remain competitive. This process of construction "globalisation" allows mature shipyards to carry out expansion and diversification at relatively low cost, and to take advantage of the lower costs of inputs found in developing economies,

Viet Nam is increasingly the destination of choice for such investment, and is positioning itself to be increasingly attractive to both domestic and foreign investors. In turn, foreign participation increases the ability of Vietnamese yards to build increasingly specialised vessels through technology and skills transfer packages that further contribute to Viet Nam's shipyard expansion.

For its part the Vietnamese government supports the rapid development of its shipbuilding industry, as this will lead to growth in other industries and will shorten Viet Nam's industrialisation process. At present Vietnamese ships contain just over one-third local content, which includes labour, welding materials and furnishings, so they are very reliant on imports of components such as major equipment and machines. This increases the price of vessel construction and slows down production. The local shipbuilding industry should benefit considerably from the support being provided by other related domestic industries, and Vinashin is striving to achieve targets set by the government to increase domestic input to 60-70% by 2020.

The Vietnamese government issued its first sovereign bonds to the international market in 2005, passing the entire USD 750 million that was raised to Vinashin for investment in raising the capacity of its yards and the quality of its manufacturing operations. To use these funds Vinashin has adopted a long-term development strategy that focuses investments on key developments. As a result, the Group has effectively upgraded and expanded many existing shipyards and constructed new shipyards in support of the development of industrial zones throughout the country.

Vinashin's Shipbuilding Science and Technology Institute (SSTI) has been upgraded to a Centre of Ship Research and Design, with its new ship model basin that is recognised as a leading national maritime laboratory.

While Viet Nam has a significant competitive advantage from its supply of relatively skilled, low-cost labour, it needs to build on that advantage through increasing productivity and an effective downstream components industry, as well as by establishing a reputation in the industry for technologically capable, high quality vessels produced on

contracted time and cost. These developments remain a challenge for the Vietnamese government and its shipbuilding industry; they will be helped in these tasks by continuing to provide a business friendly investment that will continue to attract FDI, technology and the transfer of business and other skills.

Notes

1. In 2006, a number of key policy documents, including the Socio Economic Development Plan for 2006-10 were adopted to reform the national economy and open it up to foreign investment.
2. The Vietnamese Government reports a literacy rate of over 90 percent.
3. The Vietnamese government's "Doi Moi" policy aims at shifting economic priority from heavy industry to three major economic programmes, namely, encouraging foreign and domestic private investment, reducing state intervention in business, and production of foods and consumer goods.
4. Information from *www.economist.com*.
5. Information from *www.economist.com*.
6. The USD 322.5 million contract was split into two, with Nam Trieu shipyard (Nasico) in Hai Phong building six ships and sister company Ha Long shipyard in Quang Ninh building the remaining nine.
7. Information from *www.vnbusinessnews.com*.
8. mt = metric tons.
9. Vinashin is constructing a new hot-rolling mill with an initial annual capacity of 350 000 tons in the Quang Ninh province near the port of Cai Lan in northern Viet Nam.
10. In Viet Nam, profitable State enterprises are expected to provide a return to the State through the payment of a tax called the "capital-use tax".
11. Viet Nam is currently protecting its domestic shipbuilding with a 10–15% import tariff on fishing and small cargo ships and 5-7.5 % import tariff on cargo ships over 5 000 dwt.
12. For example, the state-run Development Assistance Fund (DAF) signed an agreement with Vinashin in 2004 to provide VND 1 200 billion (USD 76.43 million) to construct five 53 000 dwt bulkers for export to the UK. This was backed by a preferential loan accounting for 65% of the total value of vessels with a 24-month payback period.
13. Information from Viet Nam Shipbuilding Industry Corporation as of May 2008.
14. Information from *www.vesamo.org*.
15. From the establishment of its first EZ in 1991 until now, Viet Nam has established a total of 137 IZs and EZs. As of November 2006, there were 2 320 foreign investment enterprises licensed in the zones, with a total registered capital of USD 19 billion.
16. This difference of $70 to $80 per worker per month would make Viet Nam significantly more attractive than China if labour costs were the only factor. However, China is currently ahead of Viet Nam in the level of its domestic suppliers and other supporting industries.

17. Under this legislation, the tax burden on Vietnamese employees was reduced, effective 1 July 2004. Key changes included the broadening of tax brackets and removal of the top marginal income tax rate of 50%.
18. Information from *http://english.vietnamnet.vn/reports/2007/03/672767/.*
19. Information from *http://english.vietnamnet.vn/biz/2006/12/640466/.*
20. This agreement is expected to open the way for ABS assistance to help VR meet the challenge of constructing large and specialised vessels.
21. Information from *www.marinelog.com*.
22. MPC Marine is a company of the Hamburg based MPC group. Its worldwide activities focus on the development of newbuilding projects with shipyards.
23. Viet Nam annually imports mechanical equipment valued at around USD 7 billion from Germany, Japan, China and South Korea.
24. Information from *www.vinashin.com.vn*.
25. cgt is Compensated Gross Tons, a measure developed by a group of major shipbuilder associations in conjunction with the OECD that provides a common yardstick to reflect the relative output of merchant shipbuilding activity in large aggregate. It is widely used by the shipbuilding industry.
26. The cgt measure was developed by a number of major shipbuilder associations, and adopted by the OECD's Council Working Party on Shipbuilding as a means of better reflecting the relative large aggregate output of merchant shipbuilding activity.
27. Reported in Asia Times Online 06/07/2007 in the article '*China`s shipbuilding wave continues to rise`*, available at *www.atimes.com/atimes/China_Business/IG06Cb01.html*.
28. Information from *www.marinelink.com*.

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