



Understanding China's naval ship building industry – lessons India can learn*

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ABSTRACT

This article examines the major shipbuilding programmes of the PLA Navy (PLAN) with the purpose of assessing the capabilities of the shipyards engaged in their construction. It analyses the reasons underpinning the Chinese Navy's ability to convert capital into assets in an efficient, time-bound, and cost-effective manner. It also examines the PLAN's organisation, structure, scale and best practices, with the aim of identifying those tenets that could be adopted by Indian shipyards to boost efficiency. The piece concludes by making recommendations on these issues.

KEYWORDS

China; shipbuilding; shipyards; MDL; GRSE; GSL; HDZH; JNCX; yard efficiency; consolidation of shipyards

Introduction

In any nation, the shipbuilding industry is a subset of its overall industrial capacity. Shipbuilding by its very nature is complex. It requires natural resources, skilled labour, expensive infrastructure, a robust ancillary industry, easily accessible capital and a supportive regulatory framework amongst others. It is therefore challenging to make a dispassionate comparison between two nations in this respect given the quantum of variables. Nonetheless, this article attempts to do so by first making a detailed study of this industry in China, then derive the reasons of their efficiency, and finally make recommendations on practices that we may consider introducing in India.

Why choose China for this study? There are many reasons for doing so, not the least of which is that they are the largest shipbuilding nation in the world today. According to China Association of the National Shipbuilding Industry, in 2018, China retained the position of the top shipbuilding nation of the world. This is based on the three primary indices of measurement in the industry which are the delivery of ordered ships, new orders received during the year, and volume of holding orders. The 2018 figures for China in each of these categories are 43.2%, 43.9% and 42.8% respectively.¹ This is a stunning achievement for a nation that entered the industry on an export driven competitive basis only in the early eighties. With respect to Military Shipbuilding, Dangfeng Cao, an authoritative china watcher posted on Twitter on 28 December 2018, a still incomplete list of the ships launched in China for the PLA Navy in 2018. The sum total of 27 vessels

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include three Type 55 and three Type 52D destroyers, ten Type 56A corvettes and two Type 071 LPDs amongst others.²

Primary PLAN shipbuilding programmes

No study of this nature would be complete without delving a little deeper into the primary shipbuilding programmes currently underway in China for the PLA Navy.

Aircraft carrier

China's yet to be named, first indigenously-built aircraft carrier (Type 001A) went to sea for her maiden sortie on 13 May 2018. From its keel-laying on 26 Mar 2015 at the New Dalian Shipyard of the China Shipbuilding Industry Corporation (CSIC),³ to its first sailing, the time elapsed was exactly three years, one month and seventeen days. This is the shortest time, post-World War II, taken by any nation in the world to build an aircraft carrier. China has achieved this in its very first iteration of a home-grown carrier. Just as a comparison, the equivalent time taken by the United Kingdom to build the *Queen Elizabeth II*, a nation well versed in the designing and building of such ships was approximately six years (as the ship was built in mega blocks at different yards, an exact date of keel laying is difficult to arrive at. Nonetheless, the first two mega blocks were mated on 30 June 2011 and the ship went to sea for the first time on 27 June 2017⁴). With regards to the PLAN, what makes their effort even more noteworthy is that the 001A is not just a replica of the *Liaoning* that had been acquired from Ukraine along with drawings and design data. There have been significant changes to the island structure and hangar thereby allowing an increase in the aircraft carrying capacity by four to six fighters. As a consequence, the displacement has also reportedly increased by a few thousand tons. In addition, the electronic suite has been substantially upgraded, the principle change being the replacement of the air cooled Type 346 phased-array radar by the far more capable Type 346A water cooled variant. The planer arrays of this radar have also been recited for optimising coverage.

If this were inadequate, work on the second indigenous carrier (Type 002) is making rapid strides at China State Shipbuilding Corporation's (CSSC's) Jiangnan Changxing (JNCX) shipyard. Photographs of an increasing number of hull sections have been regularly posted on Twitter. What's more is that these sections have been seen to have been placed abreast each other with small gaps, presumably for resolving alignment related issues that would have the potential of incurring costly rework at a later date when final mating is undertaken. The extension of the dry dock where the final assembly will reportedly take place, by a length of 200 metres, to an overall length of 560 m has also been completed.⁵ The fact that the construction of the vessel is being undertaken at JNCX is indicative that it will be conventionally powered. That being said, the design will have a considerable departure from its predecessor, the Type 001A. The increased beam of the sections being fabricated (measured to be 41 m on Google Earth) speak of an estimated displacement of 80,000 tons. The removal of the ski-jump from the one-is-to-one mock-up of the vessel at the 701 Institute at Wuhan leads one to the assumption that the "Short Take Off But Arrestor Landing" (STOBAR) configuration of the 001A will be replaced by a "Catapult Take off But Arrestor Landing" (CATOBAR) system. Given

reports that the shore based “Electro-Magnetic Aircraft Landing System” (EMALS) prototype at the Huandicun airbase in Liaoning has attained a high degree of maturity, it is quite probable that the 002 will leapfrog past the steam catapult and adopt an EMALS variant directly.

In a clear reversal of roles, it has even been reported that CSIC’s Dalian shipyard may render repair assistance for the damage suffered by the Russian aircraft carrier *Kuznetsov* as a consequence of the sinking of the PD-50 floating dry-dock in which she had been docked.⁶ This, once again, is reflective of the enormous strides taken by China.

Type 55 Renhai class destroyer

At an estimated displacement of 12,500–13,000 tonnes, the Type 55 is currently the largest destroyer under production in the world. Her size can only be rivalled by the United States Navy’s *Zumwalt* Class, a programme that had to be truncated to three ships due to unprecedented cost escalation that resulted in the cost of the three ship programme amounting to \$ 23 billion.⁷ To make matters worse, the Advanced Gun System (AGS) installed on these ships has been stalled due to the high cost of the projectile and there is no clear way ahead in sight. The PLAN have adopted a far less risky strategy in the design of the Type 55. Moving ahead from the Type 52D design, the number of vertical launchers on this platform have been increased to 112. Stealth has been improved by going in for an integrated stack-cum-superstructure as also by replacing all mechanical arrays with phased array sensors. As in the case of the aircraft carrier programme, integration issues were largely resolved in the ship integration facility at the 701 Institute in Wuhan thereby giving a high degree of confidence in the programme. This is evident from the fact that simultaneous construction of numerous ships has commenced right from the start with four having been launched within less than two years and at least four more under different stages of construction; all prior to the first of class even being commissioned.

Type 52D Luyang III Class destroyer

The highly capable Type 52D *Luyang* III Class of destroyer continues to be built in increasing numbers. Three of these ships were launched in 2018. Under construction in Dalain and Hudong Zhonghua (HDZH) simultaneously, they are being launched at an average of one every 129 days.⁸ Being the first to adopt a universal Vertical Launch System capable of fielding a variety of munitions, they are increasingly becoming the backbone of the PLANs destroyer flotillas. The approach adopted by the PLAN for risk reduction in the construction of large surface platforms is evident in their destroyer programme. Having gradually weaned themselves away from reverse engineered Soviet technology, they embarked on the construction of large multirole platforms in the early nineties with early variants of the Type 051 and 052 ships. No more than two vessels were built of each of these classes, with incremental improvements being made from class to class. It was only with the Type 52C *Luyang* II that adequate confidence was gained to build six of the type. Insofar as the Type 052D *Luyang* III is concerned, the maturity of the design is evident by the fact that 20⁹ have already been launched and it is anticipated that between 24 and 30 of the class will finally be built.

Type 54A Jiangkai II Class frigate

The series construction of the Type 54A *Jiangkai* II Class of frigate for the PLAN is drawing to a close with the 30th platform having been launched from the Huangpu Wenchong shipyard at Guangzhou, on 30 June 2018.¹⁰ Production to meet export orders (four from Pakistan as of now) as also those from the China Coast Guard (which has adopted a similar design) however, continues. China has been building these 4000 ton frigates in two different yards since 2012 with the average launch interval being four months and ten days. They have been the workhorse of the PLAN, inevitably being a part of every deployed flotilla with missions ranging from anti-piracy off the Horn of Africa to high end Joint Sea exercises with the Russian Navy. The class is likely to be followed by an updated Type 054B frigate, which though of similar dimensions, is likely to be the first Chinese combat platform with Integrated Electric Propulsion (IEP).

Type 56A Jiangdao Class corvette

The Jiangdao Class corvette is truly representative of the scale and efficiency of military ship-building in China. Under simultaneous construction in four shipyards, there is one being launched every six weeks on an average. The 60th iteration of the class was launched on 9 May 2019 at Huangpu Wenchong.¹¹ At the current rate of production, within a couple of years it will surpass the Arleigh Burke to become the most ubiquitous class of warship globally. The class is also being exported with variants in service with the Navies of Bangladesh, Algeria and Nigeria. Her sub-1400 ton displacement is deceptive when compared to her capabilities. The *Jiangdao* is a frigate in every respect. She is equipped with a 76 mm gun and four strap on inclined launchers that can be armed with either YJ 83 anti-ship missiles or Yu-8 Anti-Submarine Rockets (ASROC). For self-defence, she carries a HHQ-10 SAM launcher. Her forte is anti-submarine warfare for which she has a Variable Depth Sonar (VDS) and a towed array in addition to bow mounted sonar. Her helicopter deck is capable of embarking a Z-9 sized helicopter. For prosecution of submarines, in addition to the Yu-8 and Z-9 helicopter, she has deck mounted light-weight torpedo launchers.

Submarines

China currently has three shipyards engaged in the construction of submarines. All nuclear submarines are made at Bohai Shipyard in Huludao whereas the construction of conventional boats are split between Wuchang Shipyard in Wuhan and JNCX at Shanghai. Insofar as nuclear submarines are concerned, it would appear that the design of both the 093 and 094 classes is still in the spiral development phase. While about six each of the Type 093 Shang SSN and 094 Jin SSBN have been made over the last one and a half decades, they can be divided into several sub-classes with incremental improvements clearly evident. However, given the tremendous augmentation of yard facilities that have taken place at the eastern end of Bohai Shipyard over the last couple of years, one could presume that the threshold of design maturity is close to being breached and we will soon witness rapid series production as in the case of destroyers.

With regards to conventional submarines, the AIP equipped Type 039B Yuan is now a tried and trusted platform. Series production continues at the rate of two to three per year.

These boats are replacing the dated Ming Class at a rapid pace and in doing so, significantly augmenting the capabilities of the PLAN submarine force. The fact that the Yuan has been selected by both Thailand and Pakistan against many alternate options speaks of its capability and competitiveness from a value-for-money perspective.

How does China build its warships so efficiently?

China has emerged as the largest warship producer in the world today. The rate of accretion of ships is reminiscent of the Cold War era. How has a nation which is a relative late starter in the field achieved this distinction? A convenient and simplistic explanation is that being an authoritarian state, the conversion of policy decisions of the government into functioning programmes is far less complex than in the case of a boisterous democracy. Governmental dictates are met with little opposition and the resources of the state are made available to adequately resource initiatives. While one may agree that strong centralised state supported planning has to contend with fewer imponderables and uncertainties, there are limits as to what can be achieved. Infrastructural, technical, regulatory, financial and skilled manpower bottlenecks have to be addressed in a coherent manner, a task all the more complex for a developing economy as there are numerous claimants for resources and the opportunity cost of inadequately thought through programmes is high. China is obviously doing something right and a detailed study to try and establish the underlying reasons of its success in shipbuilding programmes is in order. Some of these are enumerated in the succeeding paragraphs.

Concurrent construction of civil and military ships

Most shipyards in the world that undertake military programmes are specialised in the field and refrain from accepting civil orders. This is based on the approach that there is little overlap between men-of-war and merchant ships. Further, there is considerable variance in the manufacturing philosophy with the primary driver of military shipbuilding being contemporary war-fighting capability and that for civil programmes being timeliness of delivery and profitability. Chinese shipyards engaged in military shipbuilding are unique in that they all owe their genesis to civil programmes. As a consequence, while they have adapted to the demands of military shipbuilding, the vast majority of them have retained their ability to service the needs of the civil shipping industry. We therefore have yards such as Bohai Shipbuilding who, while engaged in the onerous task of building nuclear submarines, continue to churn out bulk carriers in large numbers. HDZH, while specialised in the construction of LPDs and frigates, remains concurrently specialised in the construction of Very Large Gas Carriers (VLGCs). So much so, there are images available on Google Earth that show an LNG carrier and Type 54A frigate simultaneously under construction in the same dry-dock! In doing so, China has taken Civil Military Integration (CMI) or what they call Military Civil Fusion (MCF) to a whole new level. Some of the advantages that they accrue in doing so are as listed below.

- ***Flattening the Sinusoidal Curve of the Shipping Industry.*** The shipping industry, being trade dependent, moves in consonance with the global economy. This becomes very challenging from a business point of view for an industry that is infrastructure and

capital intensive. Ramping up and scaling down production to be in sync with the twists and turns of the global economy is expensive and often impractical. Concurrent construction of civil and military ships gives planners a certain amount of flexibility in evening these undulations. Surges in military shipbuilding could be used to partially fill the troughs created by economic downturns thereby maintaining a threshold of yard loading. One could make the argument that the current surge of military orders in China is partially driven by these reasons.

- **Yard Efficiency.** Commercial shipbuilding is a highly competitive industry that works on wafer thin margins. The often contrary demands of quality and cost competitiveness require the management to be agile, innovative and efficient in all their processes. This forces them to introspect and reinvent themselves so as to constantly be a step ahead of the competition. Chinese yards, having captured more than 40% of the global market have over the years learnt to function in such an environment. Being engaged in concurrent construction ensures that these skills imbibed by shipyard management are seamlessly transferred to military programmes. It therefore comes as no surprise that the cost of construction of warships in China is significantly lower than what prevails in other parts of the globe.
- **Learning From Contemporary Civil Shipbuilding Techniques.** Civil shipbuilding has been at the forefront of innovation in several spheres. While bulk carriers and to some extent, container ships may be regarded as relatively simple vessels, the same description cannot be applied to Very Large Gas Carriers (VLGCs), cruise liners and a variety of specialised ships such as suction cutter dredgers and mammoth Floating Production Storage and Offloading (FPSO) vessels. Some of these ships require fabrication and welding techniques far more complex than that used on warships. Shipyards are essentially integrators of equipment provided by a wide spectrum of equipment manufacturers. In that sense, the complexity of integrating systems in a cruise ship would match that of putting together a destroyer. On this issue, noted China scholar Andrew Erickson in his recently published paper on China's Shipbuilding writes, "High-tech, high-value-added, and high reliability commercial ships – for example, Liquid Natural Gas (LNG) and Liquid Propane Gas (LPG) tankers, Very Large Crude Carriers (VLCCs), high-capacity container ships carrying more than 10,000 Twenty-foot Equivalent Units (TEU), and even cruise ships – can be directly relevant to warship production in a way that building simple ships like bulk carriers is not."¹² In some cases, there are far more direct benefits that military shipbuilding has garnered from its civil brethren. The genesis of Integrated Electric Propulsion (IEP) for instance can be traced to the cruise liner industry. Its increasing adoption on warships is a relatively recent phenomenon. Modular construction is another example where fabrication techniques pioneered in civil programmes are now finding widespread use in military shipbuilding.
- **Ability to Surge Military Shipbuilding.** Concurrent production of military and civil ships permits yards to keep a wide spectrum of skills alive in their facilities. While the summation of both these programmes will be capped by overall yard capacity, there exists flexibility in deciding the quantum of each. By going in for concurrent construction, China retains the ability to significantly ramp up its military programmes should it feel the need to do so by scaling down on civil construction. Few nations have this ability.

- ***Dealing with Sanctions.*** China has had to live under a sanctions regime through most of its recent history. A short window with regards to access to western technology that opened in 1980 with the accord of Most Favoured Nation (MFN) status by the Jimmy Carter administration was slammed shut in less than a decade as an outcome of the Tiananmen Square incident. Under such restrictions, access to technology for warship construction has been a challenge. Concurrent civil and military construction has facilitated the unfettered diffusion of technology ostensibly acquired purely for civil programmes into military construction. A telling example of this would be the use of propeller milling machines acquired from Toshiba in military programmes.

Addressing capacity shortfalls

Over the past two decades, China has set up several large green-field shipyards. In addition, deficiencies in legacy yards have been holistically addressed. A good example in this respect is Shanghai's Jiangnan Shipyard. The land occupied by this legacy facility on the banks of the Huangpu River was identified for redevelopment for hosting the 2010 Shanghai Expo. Construction of ships was therefore terminated in 2008 and the entire facility was relocated to nearby Changxing Island in the Yangtse River. In doing so, the 200 acre yard was expanded to one that now occupies close to 2000 acres. Facilities that include a large wet-basin and several dry-docks were rapidly constructed. The yard is now building 400 m long container-ships as well as the PLAN's second indigenous aircraft carrier, ships that would have been impossible to build in the old facility. Bohai Shipyard at Huludao is another yard that deserves special mention. Though this facility occupied nearly a thousand acres, a significant part of it was unusable due to mountainous terrain. The setting up of new production facilities to augment the construction of nuclear submarine required more land in the vicinity of the dry-dock at the eastern end of the yard. The solution was found in reclamation and over the last five years, close to 1500 acres have been added to this yard. It can thus be seen that rather than look at interim piecemeal fixes, the tendency has been to address capacity shortfalls in a far more comprehensive manner.

Compressed build period and adherence to production Schedules

China has perfected the art of churning out ships in rapid succession of one another. It now takes them no longer than two and a half years to manufacture and commission a destroyer sized vessel. In comparison, going by past experience, in India it takes us roughly about seven to eight years. The recent simultaneous launch of two Type 52D destroyers at Dalian on 10 May 19 is a telling example of China's construction speed. The dock in which these ships were constructed was vacated on 03 Jul 18 after which assembly of these ships on the dock floor began. From keel laying to launch, these vessels have therefore taken less than ten months. Production duration directly impacts cost and it does so in numerous ways. This is evident from the fact that the reported cost of the *Jiangkai II* frigates ordered by Pakistan are 350 million dollars per ship. In sharp contrast, the contract value of India's seven ship Project 17A programme is Rs 48,238.91 crores.¹³ This amounts to approximately one billion dollars per ship – three times the cost of a *Jiangkai II*. Undoubtedly this is not an apples-to-apples comparison as the Project 17A will displace 60% more than the *Jiangkai II* but the figures are still

indicative of a high cost differential. Some of the underlying linkages of cost with production duration are enumerated below.

- **Interest Burden on Capital Deployed.** This is a hidden cost of warship production in India as it does not get reflected in any of our account books. The cost of capital in India is as it is much higher as compared to most other large economies. A prolonged production period in such an environment is a double whammy. A seven to eight year build period when compared to one spanning two and a half years implies that deployed capital is being tied up for five additional years before equivalent gains of having a deployable asset accrue. Considering the cost of capital to be a conservative eight to ten percent, this factor alone results in the cost of our ships rising by roughly two third over the contracted price.
- **Productivity.** High productivity is the outcome of effective management. Archival data indicates that while Mazagaon Docks Ltd took 10.8 million man-hours to build a *Godavari* Class frigate, the average labour used by a US yard to build an *Oliver Hazard Perry* Class frigate, a ship of roughly the same dimensions, was a mere 2.5 million man-hours.¹⁴ This is a telling testimony to the state of Indian yards. While practices and procedures have undoubtedly improved in subsequent programmes, the scope of enhancing yard productivity still remains high and there is a lot that remains to be done in this sphere.
- **Overheads.** Yard overheads have a linear relationship with production duration. The longer it takes to build a ship, the higher will be the overheads by an equal proportion.

Consolidation of shipyards

As part of the “opening up” phase launched by Deng Xiaoping in the early eighties, shipyards in China were consolidated under one large State Owned Enterprise (SOE) called the China State Shipbuilding Corporation (CSSC). This was closely followed by the adoption of Lloyd’s standards for shipbuilding, a step taken to ensure quality construction that would propel exports. While consolidation brought about considerable efficiencies, in the late nineties China was advised to break up large state owned monopolies into smaller companies to facilitate entry into the World Trade Organisation (WTO). As a consequence, on 1 July 1999, under a State Council initiative, the Chinese government split its top five Defence and Technology Corporations into ten new enterprises. As part of this restructuring, the China Shipbuilding Industry Corporation (CSIC) was carved out of the CSSC. The split was done based on geographical considerations with shipyards to the north and west of the country coming under the ambit of CSIC and the rest remaining with CSSC. As part of this arrangement, nearly all the research institutions engaged in maritime research transferred to CSIC but yet continue to provide cover to CSSC. It is thus evident that even though both these large conglomerates are commercially distinct and separate companies, the inter linkages between them remain strong.

High indigenisation

As mentioned earlier, China has been subject to an arms embargo from western nations since 1989.¹⁵ Even before that, with the exception of a brief decade, they have not had

access to western technology. When ties with the Soviet Union also got strained in the early sixties, China had no choice but to depend upon home grown solutions. As a consequence, the PLAN is unique amongst the navies of developing nations in that the degree of indigenisation of their platforms is exceptionally high and could be estimated to be well above 90%. The corresponding figures for India are woefully low. The report of the Parliament's Standing Committee on Defence for the year 2017 mentions that the import content for the Project 17 *Shivalik* Class is 48%, and that for the Project 15A *Kolkata* Class is 43%.¹⁶

What bearing does indigenisation have on cost? Given the fact that wages in developing countries are substantially lower than those prevalent in developed economies, the cost of goods and services produced tend to be commensurately lower. As currency exchange rates are driven by market forces based on demand and supply, more often than not in the case of developing nations a substantial variation exists between the nominal exchange rate and one based on actual purchasing power. The World Bank has established a methodology of measuring such distortions by using a Purchasing Power Parity (PPP) matrix which relies on the cost of a standard basket of goods and services, to arrive at a more meaningful value of a nation's currency. Taking recent figures into consideration, the Chinese Yuan is undervalued by a factor of 1.87, and the Indian Rupee by a factor of 3.65.¹⁷ If one were to assume that the PPP in the case of shipbuilding is no different from the index used by the World Bank, China should be able to make their ships at roughly half the cost of western nations and in our case it should be nearer a quarter the cost! However, what needs to be remembered is that the multiplier applies only to indigenous content. If significant contents of domestically made ships were to be imported, the PPP advantage would dissipate rapidly. Therein lies the cost advantage of indigenous construction.

Stupendous production runs

As a thumb rule, the cost of Research, Development and Engineering (R D & E) incurred by a shipyard in building a new class of warship equals the cost of one platform. This applies to mid-sized ships and will certainly not hold true for large expensive ships like aircraft carrier and LPDs. Going by this approximation, if one were to order a class of three destroyers, you end up paying for four which is a 33.3% premium on the actual manufacturing cost. On the other hand, if the class were to be one of 30 ships (as in the case of the Type 054A frigate), the premium reduces to 3.3%. Add to this, export orders (currently four ships for Pakistan) and use of the same design by the China Coast Guard for their large cutters, and the savings increase even further. The PLAN with its huge orders thus has a significant cost advantage. In addition, there is a yard learning curve that applies from one platform to the next in repeat orders. Lessons learnt are seamlessly applied and the quantum of rework diminishes sharply. Given the size of the order, yards are also more agreeable to invest into complex jigs and special tools which are labour saving. All this contributes to reduced costs. In this regard, as an example, the Canadian Halifax-based shipyard, Irving Shipbuilding Inc, recently reported a 40 per cent saving in manpower between the first and second hulls of the Arctic and Offshore Patrol Ship (AOPS) programme, primarily achieved by incorporating lessons learnt from the first iteration of the programme.¹⁸

Amalgamation of R & D with industry and clusterization

In a significant departure from the practice followed in India, The R & D organisation in China is placed under industry. The official website of the CSIC states that the group employs more than 40,000 highly qualified engineers for staffing “six national class R & D centres, nine national class laboratories and twelve national class technological research centres, along with 150 large-scale laboratories”.¹⁹ The research organisations mentioned in the site are engaged in cutting edge research on a wide spectrum of naval applications ranging from nuclear propulsion to corrosion resisting paints. Further, often, they are clustered with companies engaged in manufacturing the products they design to form group companies. This makes the interface between the designer and manufacturer much more robust. As both are also responsible to the same parent company, there is far greater alignment and much less friction between these entities.

The PLAN also ensures a strong user interface in this entire process by embedding naval officers in design and integration facilities. Shortfalls in technical knowhow at Research Institutes are addressed by collaborating with universities. A good example of this structure is the 701 Institute at Wuhan that designs the PLANs principal surface platforms. Like most other Research Institutes, it is owned by CSIC. It, however, collaborates with the Wuhan Institute of Technology, a well-known university in the field of science and technology with which it is co-located. Further, the institute fields a large number of Naval Officers in its staff to cater for vital user inputs. The Ministry of Defence, through the PLA Academy of Military Science (AMS), provides broad policy guidance to the defence-related SOEs and even undertakes research in some cutting-edge areas.

Placement of R & D facilities under SOE conglomerates engaged in shipbuilding makes them far more efficient and accountable. Research and developmental activities undertaken are focused and result oriented with strong applicability in ongoing programmes. The success of this approach is evident from the growing capabilities of Chinese equipment, across the entire spectrum of naval warfare.

What can India adopt from the Chinese model?

Having analysed military shipbuilding in China, one can now endeavour to identify those “best practices” that would have applicability in India’s context. Some of these are enumerated below: -

Merger of public sector unit (PSU) shipyards

Like China, naval shipbuilding in India is dominated by the public sector. There are five large yards that execute the bulk of naval programmes. The similarity, however, ends there. Four of our yards come under the ambit of the Ministry of Defence (MoD) and one under the Ministry of Shipping and Transportation (MoST). Each of them operates as an independent entity and compete against one another when it comes to bidding for naval contracts. As they view each other as competitors, there is little appetite or inclination for collaboration. In an industry where the quantum of orders is relatively small, a fragmented set of shipyards results in many inefficiencies. World over, the overarching theme amongst shipbuilders are merger. The two principal naval shipbuilders in the

United States, Huntington Ingalls and General Dynamics are a product of many smaller entities that have been acquired over the years. Even in countries where naval shipbuilding is dominated by the government, large scale merger, as done in China, has been resorted to. In Russia for example, a series of Presidential decrees were issued a little more than a decade ago to bring shipyards in the North, in the Baltic, and in the Far East under one umbrella commercial entity, that being the United Shipbuilding Corporation (USC). This was based on a clear understanding that there was far more to be gained by getting facilities owned by the government to collaborate rather than compete. The case for the amalgamation of PSU shipyards is therefore strong. There are many home-grown examples of large public sector corporations with dispersed production facilities; the Steel Authority of India (SAIL) and the Indian Space Research Organisation (ISRO) to name a few. Any of these could be used as a model for merger of our yards. Such a step would bring in its wake, numerous advantages in terms of improved efficiency. A few of the gains that could be realised are enumerated below:

- **Optimisation of Yard Loading.** The financial health of our public sector yards is varied. Amongst the MoD yards, MDL and GRSE have robust outstanding orders that will keep their slipways busy for several more years. GSL, while not loaded to the same extent, has made a niche for itself in the OPV market where a regular stream of naval and Coast Guard orders keep it busy. Work will also pick up after the conclusion of the MCMV contract which after a long hiatus is beginning to make progress again. The yard in a precarious state is Hindustan Shipyard Ltd (HSL), particularly after the decision to award the INS *Teg* follow-on frigates to GSL on nomination basis,²⁰ a programme that HSL was hopeful of getting. Insofar as MoST is concerned, as work on the first Indigenous Aircraft Carrier (IAC 1) at Cochin Shipyard begins to draw down, the yard eagerly awaits the order for the follow-on IAC-2. The point being made is that there is inequitable distribution of work amongst PSU yards. Rationalisation of work load enabled by merger would boost efficiency
- **Addressing Infrastructure Deficiencies.** Several of our shipyards are legacy facilities set-up by the British or soon after independence. The industry has changed significantly since then. The size of vessels has grown as has their draught. Both MDL and GRSE are severely handicapped in this respect. MDL has to restrict the weight of the ship at the time of launch thereby limiting the amount of pre-outfitting that can be undertaken. Even then, it is necessary to make use of pontoons while launching large destroyers. GRSE is unable to install underwater appendages on ships while they are still located in the yard. This necessitates ships going to a different facility on the East Coast for their installation. Once fixed, returning to the yard to attend to defects is challenging. Both MDL and GRSE still use traditional slipways for launching vessels. World over, shipyards are switching over to horizontal construction as against inclined, either integrating ships in a large dry-dock or doing it at ground level and then using a ship transfer mechanism along with a synchrolift to launch them. Space limitations at both GRSE and MDL make adopting this approach difficult. Both these yards are well under a hundred acres. As a comparison, JNCX in Shanghai is about 2000 acres and growing! Attempts to address shortfalls by setting up expensive green-field facilities would make sense only if there were no cheaper options. This does not hold good in our case as alternate facilities already exist (in HSL for example) and that too under government

ownership. It is purely commercial barriers that prevent us from seamlessly shifting work from one facility to the next to enhance optimisation and address infrastructural deficiencies. Amalgamation has the potential to break down these barriers.

- ***Diffusion of Best Practices.*** Shipyards, if well managed, improve with time and experience. Lessons learnt while building a ship get analysed, documented and seamlessly applied to either the next of the class or even to a different class of ship. In our present structure, while this may be occurring within a yard, it certainly does not happen across yards. The reason for this is purely structural. As long as our PSU shipyards view each other through the prism of competition, sharing of best practices will remain an uphill task. Merger will allow the free flow of information and personnel between yards. It would facilitate sharing of resources thereby dispensing with unnecessary duplication of expensive equipment and software. With the removal of commercial firewalls, collaboration driven by profit maximisation would become the predominant theme. This would have the potential of significantly bringing down cost as well as enhancing the quality of ships built.
- ***Ensuring Standardisation and Creating a Reliable Vendor Base.*** A constant grouse of the Navy is the lack of standardisation of equipment amongst our platforms, both within the class and more often between classes. Merger would facilitate centralised procurement of equipment for all programmes being executed across all public sector yards. This has the potential to become a game-changer insofar as standardisation is concerned. It would go a long way in reducing our inventory base as also streamlining our repair infrastructure. Further, given the much larger order quantities that centralised procurement would allow, enhanced price savings by driving hard bargains with vendors would be the norm. Suppliers would also be more forthcoming to invest in capability upgrades to fulfil attractive order quantities. We would therefore have the advantage of dealing with a reliable and less fragmented vendor base. A positive fallout would also be enhance indigenisation and reduced dependency on foreign vendors.

Reduction in the number of classes of ships resulting in longer production-runs

As mentioned earlier, considerable savings in shipbuilding programme can be made through amortising the R, D & E costs over a large number of platforms. The Chinese have perfected this art by what they call “harmonization” of classes. Insofar as surface combatants are concerned, they are down to four classes that fall under the classification of a corvette (Type 56A), frigate (Type 54A), destroyer (Type 52D) and large destroyer/cruiser (Type 55). This approach needs to be emulated. We could very well have a common hull design for training ships, survey vessels and OPVs. Taking another leaf from the Chinese book, there is no reason for the Coast Guard and Navy to have separate designs for their OPVs.

Corporatisation and promotion of a vibrant private sector in shipbuilding

A merged PSU shipbuilding conglomerate could progressively be given greater autonomy in handling their affairs with minimal governmental interference. With time, government could even consider vacating its position as majority stake holder. Private entities by nature tend to be far more innovative and efficient in their functioning and this needs

to be leveraged. Genuine competition also needs to be ensured through encouraging private entities to participate in the sector. This would require a certain amount of hand-holding and nurturing in the early stages as it is not feasible to provide a level playing field in the bidding process when PSUs have the advantage of inexpensive legacy infrastructure and intermittent government grants for upgrading their facilities.

Conclusion

China provides us a good reference point in carrying out a dispassionate assessment of our domestic naval shipbuilding industry. We are both late starters, have had to deal with capital and technical constraints, and have abundant manpower. While not in any way discounting the achievements we have made, it is apparent that there have been many missed opportunities in the past and there exists immense scope for improvement. We would be foolish to shrug off the strides made by a nation that in an extremely short span of time has emerged as the largest shipbuilding nation in the world in most parameters, conveniently linking it to an authoritarian style of government.

The first step to bring about reform is to discard a self-congratulatory approach and recognise that we have a problem that urgently needs to be addressed. Next, we need to study what has worked for others and try and emulate the same domestically. Undoubtedly reforms would have to be adapted to conditions that prevail in India and there is enough talent available to do so. Will we be successful? Well we will never know without trying.

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