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Make in Japan to Made in Japan: Indigenisation Lessons from the Imperial Japanese Navy 1880- 1941

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About the Author

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In your opinion, what is the major difference between the Imperial Japanese Navy and the JMSDF?
The name.[1]

Anonymous Lieutenant Commander, JMSDF
(Command & Staff Course, Maritime Staff College, 2005)

Introduction

Although Japanese governments of the early 20th century had begun working quite closely with the British government in London and with the Colonial government in India (during Curzon's time), it was, strangely the Imperial Japanese Navy's unambiguous victory over the Tsarist Russian Navy at Tsushima during the ongoing Russo- Japanese War of 1904-1905, that perhaps impressed many Indians including a young Jawaharlal Nehru and Mohandas Gandhi.[2] Nonetheless, the story that the author shall try and narrate in this paper is not about the political outcomes of this very decisive battle at sea, nor about the strategy and tactics of the Imperial Japanese Navy (IJN) but about the way in which this Navy, and effectively a newly energised Japan consequent to the Meiji Restoration (1868), went about making a 'Make in Japan' fighting navy that in the next twenty years was well on the way to becoming a 'Made in Japan' force. By the end of 1920s, the IJN was a self-reliant navy in its true sense. They had achieved '*Jiritsu*' (self-reliance, or '*swavalamban*' in Hindi) under some very challenging circumstances and beginning from an almost novice level of technical achievement and technical education at the start of the Industrial Age. In 1870, Japan could be said to be well behind contemporary colonial India in most parameters. Moreover, it would not be incorrect to say that Japan, at the dawn of the Meiji era in 1868, or even perhaps in the 1890s was still more disadvantaged than India was at the dawn of her own freedom in 1947. How did they do it? How did the Japanese nation and her navy first ignite and then sustain the fire in their belly to overcome their odds? How did they continue to "Bend(ing) Adversity" as the title of a fine book suggests and which was pointedly reviewed by Shri Ram Madhav under a title "Make in India, Learn From Japan"?[3] What indeed could we

[1] Alessio Patalano, *Post-war Japan as a Sea Power* (New York: Bloomsbury, 2005), 61. The book end note explains that this was quoted from Namae nomi, Anonymous Lt commander, JMSDF, 20 August, 2005. The book provides an excellent review of the linkages between the IJN and JMSDF in terms of spirit, tradition and legacy. On page 31, the author writes " As a former naval officer put it after the Pacific War, in the Japanese navy an officer was a 'patriot, a seaman and a gentleman'… " The story being attempted in this paper is underwritten by a sense of patriotism that permeated through most activities in the indigenisation of the IJN.

[2] Sudarshan Shrikhande,"Fear, Honour & Interest: The Wake And The Bow Wave of the Dynamics of the Indo-Pacific" in *Perspectives of the Indo-Pacific Region: Aspirations, Challenges And Strategy*, ed Sandeep Dewan (New Delhi:United Service Institution of India, Vikas, 2014), pp 78-80. Nehru as a young student in England suddenly visualized 'Indian freedom and Asiatic freedom from the thralldom of Europe.' In Africa, as relatively unknown lawyer, Gandhiji predicted 'so far and wide have the roots of Japanese victory spread that we cannot now visualize all the fruit it will put forth.' As Viceroy, Curzon, too, feared that 'the reverberations of that victory have gone like a thunderclap through the whispering galleries of Asia'.

[3] Ram Madhav, "Make in India, Learn From Japan: Post-war Japan bent adversity into opportunity. Can Team Modi do the Same?" *Indian Express*, August 1, 2015, 15. This review inspired this writer to read the remarkable book: David Pilling, *Bending Adversity: Japan and the Art of Survival* (London, Penguin, 2014).

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learn from something that began nearly a century and a half earlier and still be considered of relevance today as our own nation begins its quest to "Make in India"? This is a story worth telling and very significant for India in its retelling.

FUKOKU KYOHEI : RICH COUNTRY, STRONG ARMY [4]

The Essence

Fukoku Kyohei was a simple, yet clear slogan that was in some ways an apex policy guideline for Japan in its quest to becoming a great power. The Restoration was a *de facto* revolution that altered the structure of their feudal society. For this, "manufacturing a sense of national identity became essential."[5] Pilling summarises the Meiji ethos thus: "*As such, their determination to learn from the west was often wholly practical. Japan must learn how to make trains, guns and floating battleships mastered by westerners, not because they were inherently honourable things to do, but because they were the tools with which they could stand up to western aggression. Their working thesis: know thine enemy*."[6] **Importantly, *Fukoku kyohei* was not a bumper sticker for Japan; it was a guiding principle for achievement.**

Guns and Floating Battleships: Kaigun

In this paper, we shall confine ourselves to the indigenisation of the *IJN* although the overall achievements of Japan from 1870s and once again, from the ashes of the Second World War are equally inspiring. The *Nihon Teikoku Kaigun*—the Imperial Japanese Navy— was in its infancy around the time of the US Civil War. *"(It), however, did not have the precursor of tradition, the naval infrastructure, or the industrial backing that the Americans did. Within forty years Japan had reached fifth place in the world's navies and, by 1920, was clearly in the third place. In another 20 years it was prepared to challenge the U.S. Navy and, in the three and a half years of naval war that followed, the Japanese Navy gave a good account of itself against the greatest naval force on the globe. This was a remarkable achievement."*[7] In comparison, the (Royal) Indian Navy, and India were better poised in 1947 for rapid growth and indigenisation than Japan was in the early years of the Meiji era. Therefore, where should we ought to be in 2047 which is but just thirty-one years away? The IJN provides us some very useful pointers.

The Beginnings of Foreign Collaboration & "Make in Japan"

Apart from seeking Dutch help in starting a small naval training centre at Nagasaki in the late 1850s, a few years after Commodore Perry's visit to Tokyo in

[4] David Pilling, *Bending Adversity: Japan and the Art of Survival* (London, Penguin, 2014) p.316. This was a slogan from the Meiji era that the current Japanese Premier Shinzo Abe makes clear links to as he steers his country once again to greatness.
[5] Pilling, *Bending Adversity*, 50.
[6] Pilling, *Bending Adversity*, 66-67.
[7] David C. Evans and Mark R. Peattie, *Kaigun: Strategy, Tactics, and Technology in the Imperial Japanese Navy, 1887-1941* (Annapolis, USNI Press, 1997) xx. This remarkable book has provided the author of the paper with a deep understanding of the Kaigun in much of its complexity encompassing the "dos and don'ts" at the levels of strategy, operations, tactics and the intimate connections with technology.

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1853, the major step was in obtaining French help in setting up the Yokosuka Navy Arsenal in 1865.[8] The *Kaigun's* childhood was quite problematic. It often was considered subordinate to the Navy; was sometimes starved of funds; and the political leadership did suffer bouts of what we now call sea-blindness. In the next few years, the IJN gravitated towards the British Royal Navy (RN). While the choice of partnering with the RN made good sense, it is likely that the belligerent behaviour of a British squadron's bombardment of the port of Kagoshima (1863) during the so-called Anglo-Satsuma and Shimonoseki wars of 1863-64 ironically helped in the shift.[9]

"Skill Japan". Some of IJN's early leaders realised that people and their skills were critical. They "*were quick to exploit this situation, recognising that the mid-century revolution in naval technology made technical competence as important as the traditional skills of seamanship…to give initial priority to the education and training of officers and men rather than to the acquisition of additional naval units*."[10] We need to note here that the importance given to education, training and skill development was a common thread at all levels in Japan. Not only the *Kaigun,* but the fledgling Yards owned by it, private yards, most industries and newly set up research laboratories put in men and precious money into skilling. This required vision as well as sagacity especially when neither success nor profits could be taken for granted. This paper shall illustrate, in the case of the Mitsubishi Nagasaki Shipyard, how skill- building led from a capacity to absorb technology to evolve into hardware that was ultimately Japanese and often better than the imported or license- produced precursor.[11] An understanding of the Japanese environment in the Meiji epoch shows us that the spirit of ***Fukoku kyohei, Rich country, strong army***, seems to have been much more than a slogan; it was a driver for indigenisation. We could pause and consider what could have been the impact of a nation-wide, serious effort was begun in 1947-48 towards "Skill India"? Was India's independence any less significant than the Meiji Restoration in 1868?

Building a "*Swadeshi*" Navy and not Merely Hulls

In examining the progress towards "Made in Japan", (*Nihon-sei*)[12], it would be accurate to state that from the earliest years of the Meiji era, the IJN's leadership seemed to be quite clear that a self- reliant navy would need to be Japanese in all its manifestations: **Float, Move and Fight**. They were under no illusions that this would be quick or easy, but they were very determined that it would need to happen. Further, they were very quick to appreciate the technological progress

[8] Evans and Peattie, *Kaigun*, 5. The Yard built a few ships to French designs. The Shogunate also purchased some French ships outright that were sail and steam powered. None of these were large 'first rates". A French naval architect, Verney set it up. Japan celebrated the Yard's 150th anniversary recently.
[9] Shrikhande, in *Perspectives*, 81.
[10] Evans and Peattie, *Kaigun*, 10.
[11] Yukiko Fukasaku, *Technology and Industrial Development in Pre-War Japan: Misubishi Nagasaki Shipyard 1884-1934* (London: Routledge, 1992). The book is based on a doctoral thesis of the role played by Mitsubishi's Nagasaki Yard. It enables an excellent insight into the methods by which the Japanese gave shape to a self-reliant IJN.
[12] Translation provided by Samik Sikand, language -research scholar based in Japan. According to him, "Make in Japan" could be translated as "*Nihon de seizou suru*".

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that was taking place in European navies as well as in the USA. At this stage, just a few illustrations provide evidence of their perspicacity. Their efforts towards development of turbines and boilers of steadily increasing working pressures: the ***Move component; secondly,*** in visualising the benefits that wakeless torpedoes with longer ranges could bring to surface ships or improved fire-control systems to gunnery and torpedoes, as well as world class optical devices: the ***Fight component***; and the potential of leveraging foreign help to make long-range submarines that could—and did-- range into the Pacific as well as Indian Oceans: the ***Float component***.[13] **The road was neither easy nor the results of their efforts necessarily spectacular; they had some setbacks along the way.** Nonetheless, the wisdom of simultaneously progressing on all fronts is inarguable. The need for so doing was felt from the early days of the Restoration. However, in many ways, the fleet under Admiral Tojo's command at Tsushima in !905 was still a "Made in Europe" fleet for the major ships including their "move and fight" elements. At the same time, many of the smaller ships, some of the major ships' armament as well as ordnance, were a combination of "Make/ Made in Japan." [***In a manner of speaking, and in terms of the contemporary discussions in our own country, Japanese Designed, Developed and Manufactured (JDDM perhaps) was already a priority and preferred attribute as has now the "IDDM" category in Indian MOD.]***

Importantly, while the battle of Tsushima Strait was a very short one, the Russo-Japanese War lasted for two years, something that naval officers today do not always factor. The steady pressure, like Mahan said, of the Kaigun was a big factor all along. Although the IJN did not deeply participate in the First World War as a key belligerent, it was more than a mere bystander to the expenditure of blood, treasure, and ordnance. IJN patrolled the Mediterranean with a squadron of destroyers; other officers were embarked in RN ships during the war and sent detailed reports. Lessons learnt were incorporated into the very same **Float-Move-Fight** constituents of a navy's overall punch.[14] In fact, Japan became an exporter of many engineered items like railway rolling stock, merchant ships and ordnance to Britain in this period.[15] Japan seems to have acquired a grasp of wars lasting much longer than the initial optimism of a quick victory by war planners. **Licensed- production could and did provide the initial means to ultimate *Jiritsu* (self-reliance), but were not felt to be adequate as a long-term answer or as a sustainable way to becoming a great power.**

Naval Aviation: Not Merely Fly, but also Move and Fight

Early Bird Vision. The mental agility of much of IJN's leadership as well as the vision some of them had in recognising the potential of military aviation was

[13] Author's research shows that the examples as given in the referenced books ibid, and subsequently richly demonstrate their resolve to move simultaneously on Move-Float-Fight fronts.

[14] For an excellent and very readable history of Japanese seapower, please read Naoko Sajima and Kyochi Tachikawa, *Japanese Sea Power: A Maritime Nation's Struggle for Identity* (Canberra, Sea Power Centre Australia, 2009). The Appendices are very useful for any student of the IJN as well as JMSDF to get started on Japanese sea power.

[15] Ian Buruma*, Inventing Japan: 1853-1964* (New York, The Modern Library, 2003) 65.

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quite remarkable. **Today, it is fashionable—but also right—to think of adopting and adapting to disruptive technologies ahead of their "activation**" dates; but often societies, nations, companies or navies fail to do so. Aviation was one such disruptive development. Between 1903, when the Wright brothers flew at Kitty Hawk and the IJN's 1909 "decision to develop a capability in this new medium", there was not much that seemed viable in aviation that could be a realistic naval fighting instrument.[16] The focus of this paper being ship and of course, submarine- building, aviation aspects are only briefly mentioned below.(For this author, this is a related area for study and also has similar and equally significant pointers for our own country as military aviation also moves towards "make in India" and to "*swadeshi*".)

Fly, Move and Fight. As in the case of ships and submarines, **the IJN saw aircraft as a conglomeration of systems that all needed to be made indigenously**. Ultimately, the large seaplanes (eg the Kawanishi H8K1), Nakajima B5N Type 97 carrier attack bomber, the Aichi D3A Type 99, carrier dive bomber, a famous fighter like the Mitsubishi A6M2 Model 21 Type 0 ("Zero") or the Mitsubishi G3M2 Model 22 and G4M1 model11 bombers were technologically advanced, reliable and cost-effective.[17] In terms of "Move", the engines made by Nakajima and Mitsubishi Kinsei, were versions of Curtiss and Pratt-Whitney imports. **These were not always better than the ones being developed and flying in US or British aircraft but sufficed in view of the constraints in materials, closure of technology infusion from the West and pressures of war itself. Importantly, for Japan, they were *"swadeshi".*** In terms of aviation ordnance, the IJN used its own Arsenals towards developing and making bombs and torpedoes as well as smaller calibre ammunition for aircraft cannons. It could leverage the considerable expertise it developed for large calibre gun ammunition as well as torpedoes. Eventually, the private sector was co-opted for production of ordnance of several types. Some interesting features of the importance given to indigenous efforts in attaining self-sufficiency in ordnance are highlighted in the next paragraph.

***Jiritsu* for Ordnance, the "Fuel" for Warfighting**. Japan's reputation for making excellent swords is a historical fact, quite apart from the exaggerations of popular Hollywood movies like *Kill Bill*, etc.[18] Just as swords first made their appearance in Japan from China sometime in the 3rd century CE, so did the initial supplies of guns, shells, cartridges and ammunition for the main and secondary batteries of the early ships of the IJN come from overseas, essentially from Europe. Navy Arsenals were established wherein the early examples were analysed and copied. Furthermore, there was widespread realisation within the Navy brass that ordnance would be the "fuel" for warfighting, and therefore moved to make

[16] Mark R. Peattie, *Sunburst:The Rise of Japanese Naval air Power 1909-1941* (Annapolis, USNI Press, 2001)1. One of the authors of *Kaigun*, ibid, Peattie presents a detailed account of IJN's aviation achievements and ultimate failure. Read in conjunction with the details given in *Kaigun,* the book seems especially useful.

[17] Peattie, *Sunburst* and Evans & Peattie, *Kaigun.* Observers of the current Indian defence media may recognise that the Shinmaywa company offering the US-2 amphibian for manufacture in India was the Kawanishi company in Imperial Japan.

[18] For an interesting overview of ancient and medieval Japanese swords and the art of "Kendo", see *A Bilingual Guide to the History of Kendo* by Toshinobu Sakai and Alexander Bennet.

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indigenous R& D a priority for itself. It is not possible here to go into details of the rapidity and the urgency with which this was attempted. Soon after it was formed, the Naval Weapons Committee had pushed for increased production of the 120mm QF guns for its new cruisers as well as indigenisation of ammunition. Based on R&D by the IJN, the more effective *Shimose* powder was developed using a version of Japanese made Picric acid, originally developed by the French. Moreover, this was then filled into *furoshiki* shells. In what was a counter-intuitive move to the thicker armour-piercing shells used by other navies to pierce decks and hulls, these shells were designed to explode on impact and cause fires and shrapnel wounds. Lighter shells enabled 10 percent of the total weight of the shell to be given to explosive as against just 2-3 percent then possible in AP shells. To top it all, a committee developed the Ijuin fuse (named after an IJN officer who steered armament R&D, later Admiral Ijuin Goro) that enabled quick activation on impact. The results were seen in the 1894-95 Sino-Japan war and again in the Russo- Japanese war.[19] Of note here are three aspects. First, the integrated approach to warfighting effectiveness from selection and testing of guns to all areas of ordnance development. Second, the determination and ability to reverse engineer ammunition and in fact, innovate new powders and fuses. Third, was the flexibility to think out of the box and emphasise HE/ incendiary effects in preference to AP capabilities. In the coming years, they did simultaneously develop AP shells and fuses for use in large- caliber guns against battleships keeping in mind enclosed turrets and thicker armour. Based on the lessons of the Battle of Jutland, the IJN developed the type 5 AP shell for 8/14/16 inch guns and, when some faults were detected in the fuse delay, the type 88 was developed. This shell was designed to be effective during an under-water trajectory upon entering water short of the enemy hull and piercing the thinner plates below. Their successes in using imported types of torpedoes aggressively and imaginatively were evident in the opening battles of the Russo- Japanese War in Feb 1904. Julian Corbett wrote of it as "the first great torpedo attack in naval history."[20] The Kaigun continued to develop torpedoes for all platforms including some very capable air- launched versions. They put in efforts into reverse engineering of fire control systems for torpedoes and incorporated improvements. Of special note is the development of oxygen- propelled torpedoes they successfully produced and daringly used in the fleet when other navies had ruled them out because of the hazard they posed in storage and handling. The Type 93 (called Long Lance by the USN) was developed in 1933 and some versions had a range of 40 km at a max speed of 48 knots. Even contemporary naval officers will acknowledge this achievement. [21]

However, Lack of Jointness! A reader should not get an impression that sagacity permeated all decision-making in the IJN. The navy was quite reluctant to work in tandem with Japanese Army aviation to achieve better research, design and development, cost- savings and even combat- training outcomes as

[19] *Kaigun*, p 17.
[20] *Kaigun*, p.97
[21] *Kaigun*, p. 266-68.

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well as in ordnance manufacturing. Much more could have been achieved had the overall relationship between the Army and Navy been better. Japanese occupation of China and subsequent operations in WW II provide some egregious examples of lack of joint planning and execution between the services. For instance, the Japanese Army, had to build escort carriers converted from merchant ships and crewed by civilians to protect its logistics convoys at sea! Space prevents us again from several other instances where greater jointness between the Army (the air force belonged within) and Navy could have yielded significant benefits to the Japanese war machine.

Apex Structures and Policy Matters for *Jiritsu* (Self-reliance)

Kaikoku Nippon. Is it just a coincidence that the phrase "Maritime India" used for a Summit held in Mumbai just a few months ago (14-16 April, 2016) or is there something to learn from ***Kaikoku Nippon***, Japanese for "**Maritime Japan**"? In 1885, the Japanese navy kick- started this campaign "*to magnify the Japanese presence in the west Pacific through increased naval strength and the construction of a modern merchant marine. The public enthusiasm resulting from this effort helped to contribute significant support within the government for the modernization and expansion of the navy*."[22] We should also note that Alfred Thayer Mahan's similar attempts at educating American political leadership, the people as well as officers of his own navy was still a few years away. (Mahan's best- known book, *"The Influence of Sea Power Upon History 1660-1783"* was published in 1890). The propaganda helped maintain a focus, furthered by Japan's growing ambitions as well China's efforts to thwarting the former's aspirations in Korea; on the need for technological infusions; larger budgets; as well as the enhancements of Navy Arsenals and private companies in commercial as well as naval shipbuilding. Actually, this campaign followed, not preceded, naval reforms. In 1872 a separate Navy Ministry was formed which initially had largely civilian officers. Admirals, with experience at sea, soon were inducted and slowly their influence increased. Saigo Tsugumuchi, a Satsuma politician, was a wise Navy minister thrice (1885, 1887-90 and again during 1893-98), a superb talent- spotter and ***"his support and engagement to those younger officers dedicated to its modernisation"*** resulted in a young officer like Yamamoto Gombei (not to be mistaken for the better known Yamamoto Isoroku of WW II fame) having a 40- year period in which to leave his mark not only on the IJN as an admiral, but as Navy minister and twice as Prime Minister.[23] Yamamoto "***stripped the navy of its deadwood, battled the army for public attention and government support, and induced the Japanese Diet to provide funds for a major battle fleet***.[24]

[22] Evans and Peattie, Kaigun, 19.
[23] *Kaigun*, 20-21. Yamamoto Gombei stands in the pantheon of admirals like Tirpitz, Fisher, Gorshkov, Rickover, Arleigh Burke who all rocked the boats of their own navies mainly as peacetime admirals and displayed the vision that prepared their navies for any future wars. They all had longer than customary tenures and generally did well for their navies. In the case of Fisher or Elmo Zumwalt (US CNO in 1970-74 and during the Vietnam war), history has given them greater respect than their contemporaries were willing.
[24] *Kaigun*, 21.

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Organisational & Personnel Reforms. "Skill Japan," as we have seen earlier, was pursued everywhere. The IJN was no exception. The new Academy at Etajima broad-based its selection on merit rather than class.[25] This was not a small or an easy transition for a traditional society and needed the shake-up of the Restoration for it to be possible. **Technicalisation was also pursued**. A few decades later, these officers formed the nucleus of not only their own Navy Arsenals/ Yards but of many companies as well and some actually founded their own. Nakajima corporation was one such. A more technicalised corps of naval officers made appreciation, absorbtion, as well as adaptation and even innovation of technology easier and, in turn, this helped the IJN in becoming "*swadeshi"* faster. Simultaneously, a Navy Staff evolved, in parallel with the changes taking place in the Royal Navy. Although the IJN interacted with many navies in Europe, sent a few officers to US Navy colleges/ schools, it cooperated most with and patterned itself on many training methods of the RN. An Indian reader may well imagine that the IJN was an intellectually poor organisation, given the strict discipline, *bushido* code or environment of deference. **In those early years, in fact, the opposite was true**. Navy Minister Saito encouraged the formation of the ***Sukosha***, a naval officers' professional organisation in 1896. The US Naval Institute had been formed in 1873. The RN did not form an equivalent until 1912. Even so, the British Naval Society was a small informal group of Young Turks that was quite frowned upon by the RN's conservative leadership more often than not. The Sukosha had "leading bureaucrats, editors, bankers, businessmen, and Diet members."[26] In a concerted manner, therefore, the very process of "make in Japan" steadily, purposefully, and relatively rapidly moved towards "Made in Japan". Of late, even if well over a hundred years after the Japanese reforms, we are at the beginnings of not a "whole of government approach', but rather, a "whole of nation approach," for "Skill India". However, even in this, the substance and not rhetoric needs to be the leading edge. As in Japan's case, this would need all stakeholders in India to genuinely sign up on skilling ourselves.

Political (Policy) Alignments. This paper does not have the space to go into the consequences of Japanese victories in the 1894-95 war with China where, despite new possessions, the situation became tense with Russian ambitions in the Far East to get greater access to Pacific coast's warm- water ports and for expanding the Trans- Siberian Railway. Japan feared the "Tri-partite" alliance between France, Germany and Russia. Not being strong enough, it ceded some territory and influence to Russia despite being the victor. "*Fukoku-kyohei*" once again became more important and resulted in a clear preference for an alliance with Britain and British help in buying ships in Europe and for "Make in Japan." As Evans says, "*it was the Anglo-Japanese Alliance of 1902, largely naval in its implications, that assured Japan freedom of action without the interference of other*

[25] *Kaigun*, 10. An Academy was initially set up in 1869 near Tokyo. In 1888 it moved to its location at Etajima where it stands even today. Alessio Patalano, in his book, *Post-war Japan as a Sea Power* (New York: Bloomsbury, 2005), (qv footnote 1) describes how the present JMSDF maintains its spiritual connections between today's Academy with that of the IJN's era.
[26] *Kaigun*, 24.

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maritime powers and encouraged the Japanese navy to think of dominating East Asian waters."[27] Although the relationship with France weakened, the IJN continued to study them closely and even interacted with Germans. As such, no windows were closed for naval technological infusions despite shifting political winds.

Naval Plan 1896. Yamamoto Gombei's 1896 Plan called for a 260,000-ton navy over a ten-year period. Salient aspects of this plan were:

- Four battleships (two "buy" in Britain; two license- built in Japan). These were to be stronger and more powerful than what the British yards initially offered. Qualitatively, these ships had to be better than the "state-of-the art"). This remained an IJN principle even in foreign design negotiations. (**Note. This writer has represented "buy" and 'state-of-the-art" as such to use terms that have been used in our own procurement processes during the past few years but have had echoes from history. We may also note the fuzziness of terms like state-of-the-art. It was certainly so during the early years of the 20th century where pre-dreadnoughts, dreadnoughts, super-dreadnoughts, or even, in Ronald Hopwood's poem, "hyper-super dreadnought" spanned the lifetime of a single generation of naval officers.**)

- Four armoured and four protected cruisers. **Interestingly, IJN managed to have two cruisers of Armstrong-Vickers design built, one each at the German Vulcan Works, Stettin and one at St Nazaire, France! What was difficult enough to do domestically, they managed among three countries!** One can imagine the homework required of the IJN and its political masters to do this amidst the tensions, competition and empire-building of the period.

- Destroyers: 23; Torpedo boats: 63. Most of these were built in Japanese Yards, mainly private. Navy Arsenals were tooled to build larger ships.

- Expansion of Japanese yards, repair and training facilities.

- Capabilities- based planning and a clear understanding that today's allies may not be tomorrow's friends.

- This plan and follow-ons became quite dynamic due to newer possibilities, technological developments, more/ less money and greater domestic shipbuilding consequent to growing industrialisation.

- An insistence on compatibility of gun turrets and ammunition across classes for better ease of "make in Japan" and for repairs.[28]

[27] *Kaigun*, 53.
[28] *Kaigun*, pp 53-63. From Chapter 3, *Preparing for Battle*.

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Forging a Nation: Leveraging Research, Design & Development

Whole of Country Approach to Technology. In the Foreword to Dr Fukasaku's thesis, her guides succinctly observe "***that competitive advantage is not God given. Japan's shipbuilders assimilated and in some time surpassed, foreign best-practice technology, and became a major world force in the industry. But this process of technological accumulation took time and involved industrial firms, and academic and financial institutions, as well as government policies. It was very different from the assumptions of strategic trade theory, that governments can create a competitive advantage by giving firms a quick pre-emptive nudge down the learning curve***."[29] The other important aspects of an integrated approach by Japan to science and technology based on Dr Fukasaku's study of Japan and specifically the Mitsubishi Nagasaki Shipyard (MNS) enable interesting inferences. A word about this Yard may be in order here. The Nagasaki Yard of the Government was leased to the relatively young Mitsubishi corporation in 1884. This company was already manufacturing some merchant ships, engineering machinery and railway equipment. Today in India we might call it the culmination of a Public- Private Partnership (PPP) model. The MNS study enables us to bring out the following broad points on science and technology:

- Technology imports and development of indigenous technology were concurrent and complementary. There is not much merit in emphasising a "late-comers" advantage in leveraging current technology. Japan in general, and Mitsubishi in particular did not have any such facilitation. **Western collaborators did not happily or easily enable technology transfer (TOT).**

- "**Thus the problems associated with transfers of technology were seen to reside with the suppliers, while the recipient firms and countries remained their passive victims**…**The crucial problem is to stimulate the development of capabilities to absorb, adapt and improve imported technology, so that, needed technologies can be supplied indigenously."[30]** In India, not surprisingly**,** this has been the case. Neither has the predicament for India been unusual. In their own way, nations and their armed forces as diverse as Australia, Brazil, South Africa, or South Korea, to name only a few have faced, and continue to face these problems. Even politico-military alliances do not necessarily become enablers for TOT.

- **Learning by doing is rarely enough** because a company can remain at the same level or make only very little actual progress. Such firms have to go on to developing their own R&D *"to relate that experience to knowledge*

[29] Yukiko Fukasaku, *Technology and Industrial Development in Pre-War Japan: Mitsubishi Nagasaki Shipyard 1884-1934* (London: Routledge, 1992). In Foreword by Professors Freeman and Keith Pavit.
[30] Fukasaku, *Mitsubishi*, 2.

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*and skills acquired elsewhere…**hence the importance of investing in R&D and training to generate skills and knowledge***."[31]

- Acquisition of knowledge requires costly effort at the company level and support from institutions. **MNS did the former and benefited from the latter**.

- **Technology Learning v/s Technology Creation**. Indian audiences would be interested in Fukasaku's sharp observation about India which is quoted here:

  - *"ITLC (independent technology learning capacity) which corresponds to the capability to assimilate foreign technology and ITCC (independent technology creating capacity) which corresponds to the capability to adapt to change, **to explain the mediocre technological performance of India, whose policy as well as social sentiment stressed the latter, while neglecting the former.** This distinction is similar to Lall's (1985) 'know how' and 'know why' capabilities in which the former refers to the ability to operate imported production processes, while the latter corresponds to the ability to change product or process technology."*[32] (Note: An honest assessment would indicate that although this observation dates to the early 1990s, the situation is not much improved today in our defence public or private sectors after the passage of over two decades. However, it could be said that now is perhaps the best political- technological- governance environment for betterment in both ITLC and ITCC as well.)

- **Control of Technology Flow**. A less- known fact about the Ministry of Trade and Industry (MITI) that has been highlighted by Pilling is that the "*Ministry that was subsequently credited by many with overseeing Japan's economic renaissance was a direct descendant of the Ministry of Munitions. In that incarnation **it had beseeched Japanese companies to work together for the purpose of increasing weapons production**. Now the bureaucrats of MITI rallied Japan's industrial potential in the interests of peacetime revival*.[33] Japan's national goal and focus in the late Meiji period and soon thereafter for rapid industrialisation required scientific frameworks that "**facilitated industrial rather than basic research. In so doing, the government successfully integrated science and technology into the national system**."[34]

[31] Ibid, 5.
[32] Ibid, 6.
[33] Pilling, *Bending Adversity*, 86.
[34] Fukasaku, Mitsubishi, 11.

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- **Steel: "The Food of Industry.**"[35] An example of the state as an enabler was the impact the lack of right quality steels on indigenous warship construction for major ships during the early years of the 20th century. A government steel mill was set up in 1901 with German skills and foreign capital. Japanese R&D in metallurgy helped them make lighter armour, more agile gun-turrets and aluminium fuselages (subsequently).[36]

- **Industrial Policies.** Surprisingly, the Ministry of Agriculture, *Noshomusho,* took the lead in the late 19th century and also was a precursor of sorts to the MITI. Over the next two decades, that included the impetus provided by the First World War, the governments coordinated capital goods manufacturing. In fact, by the end of the war in 1918, half of Japan's machine tools were "*swadeshi.*" Electrification was largely completed by then and gave a boost to chemical and fertilizers, stimulating food-independence and agriculture exports. Lest a reader believe that Japanese companies needed hand-holding or prodding, the opposite was true. in **The passion for *Jiritsu* was so high in companies** that they figured out that first, if they themselves built or bought domestic machine tools, their costs would come down; **second, re-tooling would be easier; third, wider application** would be feasible in complimentary/ related industries of shipbuilding, railways, vehicles, farm machinery etc. **Fourth, they were fired up enough to allow themselves to be coordinated by the government in a manner quite different from the system implemented in Leninist or Stalinist Russia.** Difficulties of imports during WW I; the imminent collapse of the Anglo- Japanese Alliance (1902-1922); increased tensions between the US and Japan and the overarching theme of *Fukoku-kyohei* all helped kindle and sustain this spirit that can be seen in today's Japan as well. **It is this writer's deep belief that Japan could not have become a great power if the levers of technology, policy formulation, military hardware were to be in one or more foreign capitals.[37]**

- **Laboratories and Universities**. Space constraints do not permit deeper treatment of the way in which Japanese governments set up research laboratories in various disciplines and fields. As Dr Fukasaku details in her book, between 1870- 1900, the government founded 13 research institutes; from 1900-1935 it began with the important Industrial Research Institute and established thirty others as well. **Some of these were affiliated to government departments** but many were with

[35] Pilling, 86-87. The phrase was used once again by MITI after it was set up to revive Japan after the WW II destruction. It became the food for the spectacular revival of the shipping industry; the automobile and railway sectors. When the JMSDF started building its own warships, the expertise in terms of quality and the handsome quantities available came in handy!

[36] Fukasaku, 20-23.

[37] Author's conclusion based on his own studies in indigenization issues within India as well as based on Pilling, Fukasaku, Evans & Peattie, Buruma and Auer. The last, James E. Auer, has helped significantly as an American naval officer in the post WW II period in the reestablishment of a Navy in the form of the JMSDF. His book, *The Postwar Rearmament of the Japanese Maritime Force, 1945-71* (Praeger, New York, 1973) is perhaps the best reference work by a participant and empathetic observer on the early years of the JMSDF. A student of today's JMSDF perhaps cannot ignore this book of reference.

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universities and polytechnics. In some, like the Institute for Physical and Chemical Research (*Riken*, for short), "University professors were appointed as researchers...(it) was indeed a **'national enterprise' which responded to the policy of strengthening government-university-industry links for industrial development**. Fundamental research was done at *Riken,* but greater emphasis was placed on industrial research which could be commercialised."[38]

- **Military R & D Linkages with Universities and Corporations**. The Imperial Army as well as Navy were very cognisant of the need for in-house R&D and for working in league with national R&D laboratories as well as helping company- steered design and development. Fukasaku notes that the army and navy together set up "The Temporary Balloon Research Committee…in 1909…(that) became the Aeronautic Research Institute of the Tokyo Imperial University in 1916."[39] Officers were appointed to do R & D in the ARI. For the IJN, the Naval Technical Department (NTD) encouraged applied research in private companies. For instance, Mitsubishi set up a company cum lab for optical research on weapons and sensors on a demand from the NTD. Learning from Krupp's R & D in 1913, the Nagasaki yard set up **the *Jikkenba*, (literally, "factory for experiments).** It had a fairly large number of people all engaged in research, design and development. Several dozen reports were compiled every year. Dr Fukasaku significantly observes that even during the recession years, the number of researchers as well as reports and designs did not automatically decline even when company laid off workers as **"indicative of the importance the shipyard attached to research during the years of recession**."[40] In a manner of speaking, therefore, the overall vision of JDDM was being attained by companies such as Mitsubishi through "Mitsubishi Designed, Developed and Manufactured" or MDDM! **To use the Indian MOD's DPP 2016 parlance, Misubishi was contributing towards the "Make 1" prioritisation. How was *Jiritsu* to be otherwise achieved?**

"Skill Japan": What Did the Yards Do For Technology Imports and Training?

We have already seen the efforts made for "Skill Japan" at the larger levels of policy and in terms of IJN's personnel reforms. More could have been said about education reforms at the school and university levels that were as vital but cannot be given space here. The approach of the Mitsubishi Nagasaki Shipyard (MNS) for **"Skill Mitsubishi**" as explained by Dr Fukasaku, however, could be taken as a template for other Japanese companies. She devotes an entire chapter to "**Technology Imports at MNS**" that spans from employment conditions for

[38] Fukasaku, *Mitsubishi*, 79- 82.
[39] Ibid, 83.
[40] Ibid, 91.

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foreigners; their own overseas missions for skill acquisition; rationale for import of machinery and materials; purchases of manufacturing and sales licenses. Another chapter similarly covers "**Education and Training at MNS**" that also explains national level education in marine engineering and naval architecture; enterprise-level training programmes; on- job training of MNS workers; the apprentice schools; the way engineers were recruited and trained in–house for specific areas; and participation in professional societies.[41]

Technology Imports/ Foreign Specialists. [42]The Meiji government did employ numerous foreigners in several areas in the industrial age and especially so in shipbuilding. From several hundreds in the 1870s, the numbers declined to fewer than a hundred in the Meiji government by 1900, largely in the *Kobusho*, i.e. Ministry of Engineering and Public Works. After this, foreigners in government employment were mainly in universities. **Foreigners in the *Kobusho* "were agents of technology transfer" whose important duty was to train Japanese counterparts to take over**. Vitally, the employment of foreigners at very high salaries was not an open ended or ill- defined plan. (We shall see later how this applied in the IJN when they used foreigners, mainly Germans, for the galvanising of modern submarine construction in the 1920s.) Before the Nagasaki Yard became a private enterprise as MNS in 1884, all foreigners, mainly French and British, had left. Mitsubishi transferred in some experts from its Engine Works in Yokohama and recruited some more rather quickly. They held most engineering positions and were made to train replacements soon. By 1900, many foreigners had been asked to leave. Apart from the quest of self-reliance, and the high salaries demanded, an important reason, and perhaps familiar in contemporary circumstances everywhere, was that ***"the foreigners were ungenerous in sharing their knowledge and the essential construction works were done secretively***."[43] Other aspects of technology exports are summarised as follows:

- **Overseas missions by MNS were numerous** in the first few decades. They were mainly engineers and technicians. The advantages these people brought ranged from inspections on site to learning about technologies to be imported; production processes; drafting of license agreements; managerial and cost- accounting systems; awareness and individual absorption of collateral technologies and processes not part of expected outcomes.

- Due to such missions and those by the IJN and other companies, Japan positioned itself to become aware early enough to leverage, as already seen in this paper, the appearance of impulse turbines towards its "Move" requirements; the R & D taking place in Germany and Britain on gunnery

[41] Ibid, Chapter 3 on Technology Imports at MNS, pp 39- 56; Chapter 4 on Education & Training, pp 57-78. Managements of Indian shipyards and of other defence enterprises in public or private sectors would benefit from careful examination of this template to see how much is being done or how to enhance skill building and getting the most out of foreign technical collaboration.
[42] This and the next section on Training is based on Fukasaku's book except where otherwise indicated.
[43] Fukasaku, 43.

and torpedo fire control systems; or the disruptive possibilities of military aviation as seen earlier in this paper. **Of note is that this was possible because the right levels of members constituted such missions with knowledge, dedication and often, youth on their side.**

- **Hard bargains were driven into some of the license- agreements**. For example, imports of Parsons turbines had clear clauses for training and rights to manufacture subsequent examples **with export possibilities**. The IJN used its "goodwill" with the RN to leverage financial benefits (i.e. profits) for the supplier to get long-term benefit to Japan. Great effort was put into "reverse engineering" of turbines and this was supplemented by the theoretical data on impulse blade technology from Germany. This seemed superior to Mitsubishi engineers, who were spending time in Germany, to the more empirical approach of the British.

- MNS spent creditable effort in making available journals, books and membership of international professional societies to its employees. This may seem an insignificant point, **but how many Indian DPSUs, PSUs or even private companies are willing to untie their internal red-tape to enable these benefits or indeed think that such expenditure is justifiable at all?** If red-tape is not a consideration, are companies uniformly happy and ready to put tangible money into the possibly intangible benefits of knowledge acquisition by these methods? These may be questions to ponder over.

Education & Training at MNS. Engineering and naval architecture became priority areas for the "*Kobusho*". From the Imperial College of Engineering, Tokyo, by 1907, 41 percent of the 191 graduates joined private shipyards and 36 percent joined the IJN and government. Marine engineering courses were started there in 1897.[44] MNS' contribution to education and training and, consequent harvests of benefits from it, are briefly given below:

- Japan had passed a Vocational Educational Ordinance in 1899. In accordance with its provisions and bettered as initiatives at company level that were not all mandated, MNS set up *Mitsubishi Kogyo Gakko* (MKG, Secondary Schools) in the same year for young boys who could volunteer to join Mitsubishi firms if they so wanted. Many did. **Idealism, patriotism, nationalism brilliantly combine with pragmatism** in the founding directive of MKG:

- **o *…the development of shipbuilding industry affects not only the profits of the firm, but also national strength…the most urgent matter for the development is the training of technicians who possess appropriate skills and knowledge in shipbuilding technology…to develop their knowledge in application of engineering in order to form the basis of***

[44] Fukusaka, 61. This writer has not yet made a comparison of equivalence in colonial India in 1907 for these disciplines. It is quite likely that the numbers even in the 1950s may not have been very high or the employment prospects of such graduates bright.

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the development of the industry which in turn will serve the public interest of the nation."[45]

- MNS helped many MKG graduates become engineers because of their individual aspirations However, once other institutions proliferated, MKG was somewhat downgraded to a workers' school in 1919 under an overall scheme of the Mitsubishi Technical Education Foundation. These apprentice graduates were mainly employed in Mitsubishi's growing factories and yards even as the company afforded them future growth as engineers and highly skilled technicians. Today, many of these measures would not be possible at enterprise- level but are **certainly ever required at the governance levels and this realisation seems to be part of the vigour of "Skill India" that needs to stay the course in its implementation.**

- Short term training programmes at various levels were widespread at Mitsubishi. Some of these were arranged abroad for special skills, in electric welding as an example. Pay incentives were offered for doing well in company exams, courses and advancement often resulted as skills were demonstrated.

- **Infusions of naval officers into Mitsubishi (as well as other companies) was valued greatly because they bought user- inputs and end- awareness**.

It may thus be seen that a company such as Mitsubishi consciously and otherwise participated in and likewise benefited from national skill building and technological progress. This is one way of looking at the actualisation of *Fukoku-kyohei*.

A Comparison with Mazagon Docks' Skilling Issues. The Leander frigate construction programme of Mazagon Docks Ltd (MDL) in the 1960s and all through the '70s provides a good example of some of this. Although the first major warship construction programme in India, it was rather well managed by later standards in terms of skill building. As per the official history of the Indian Navy, for the Leander project, more than 150 workers and technicians of MDL were sent to Vickers for training from six months to two years. For the Type 209/ 1500 submarines built in the 1980s under license from HDW, Germany, a larger number were trained and with excellent results. **These MDL employees absorbed much and returned to work and train others.**[46] Imagine how difficult it would be to get approvals for similar numbers today? It is understood that for the Project 75 submarines, the numbers have been in very low double-digits. What if several more dozens of workers and technical supervisors,

[45] Fukasaku, 66.

[46] GM Hiranandani, Vice Admiral (Retd), Transition to Triumph:Indian Navy 1965-1975 (New Delhi, Naval Headquarters, 1991) 39-56. The data given for the Type 209 and Project 75 Programmes was informally conveyed to this writer by an MDL official who did not want to be acknowledged.

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draughtsmen and engineers were to be sent and then return and not only work with greater knowledge and passion but also train other colleagues more effectively? What might have changed in the processes, zeal and vision within the MDL towards skill- building; or the roadblocks within the approval apparatus within agencies in Delhi; or the reluctance of the OEMs abroad to enable skill-building or in combination of all these factors that make P- 75 a different case? Indeed, what is the larger "harvest" like the one that MNS of Japan reaped, that ought to have been reaped from skill- building for P- 75 to the actualisation of the P-75(I) submarine building programme? **Skill- India, therefore, requires vision and execution that is analogous to Mitsubishi's vision highlighted a few paragraphs earlier in this paper.**

FORGING THE *KAIGUN* (NAVY)

Public and Private Sector Shipyards. Having thus far seen how a resurgent nation was being forged, attention can be once again turned to shipbuilding. From the early days, Japanese warship building predominantly began in government yards but in very small numbers. For the 1896 plan, the assessment was that **about "90 percent of the 234,000 tons of naval construction contracted for the ten years beginning 1896-97 was to be foreign built (mainly British) and, when completed, would comprise 70 percent of the Japanese fleet**."[47] The Navy Arsenal from near Tokyo (Tsukiji) was moved in 1896 to a new site at Kure and expanded facilities were built up; Sasebo was set up in 1897. Kure, in fact addressed not only **Float but Move and Fight** equipment as well. Japanese engineers developed the Miyabara boiler which was simpler and more robust than imported versions. **By 1912, it began to develop its own turbines**. In that year, its first turbine equipped capital ship, the *Ibuki*, joined the fleet. It may be noted that HMS Dreadnought, the first warship to put to sea with a steam turbine was then just over seven years old.[48] "**Working from basic foreign designs or information, the Japanese developed the Yamanouchi quick-firing cannon, the Oda mine, the Makimura torpedo, and the Kimura radio telegraph**."[49] As seen earlier in the paper, R&D on explosives received attention and resulted in much innovation. *Shimose* powder and the *furoshiki* shells were early examples of an important field for "*swadeshi*" where Indian Ordnance factories as well as the private sector failed post- Independence.[50] The private sector, which had started building merchant steamships, also moved into this business opportunity. This was not

[47] Evans, *Kaigun*, 60.
[48] Evans, 159.
[49] Evans, 63. The end-notes do state that industrial "espionage" may have played a role in indigenisation. This would not have been unusual at all. In the world of military hardware, the "west" was engaged in this with some amount of energy in the 19th & 20th century. Katherine C. Epstein documents some instances in her book, *Torpedo: Inventing the Military- Industrial Complex in the United States and Great Britain* (Harvard, 2014).
[50] Evans, 63. The elaborate infrastructure of the Indian Ordnance Factories or the expertise of private players like the Indian Explosives Ltd was never really exploited for any cutting edge research or even for any major import substitution of military explosives and shell development. When compared to the resolve and passion shown by the Japanese, our failures are even more egregious. But this needs to change. OFBs represent investment, infrastructure and even perhaps unexploited human talent. As far as this author can surmise, not much R&D exists even in a core area as bullets for 7.62/ 5.56 mm wherein, media discussions do not go beyond discussions of the caliber as opposed to the real advances made in the effectiveness of 5.56 and 7.62 mm rounds themselves.

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unusual**. Many European private shipyards were "dual use."** In fact, in a very important book "Navies and Shipbuilding: the Strained Symbiosis", the authors put it well in the preface: "**This is…our central theme, that of mutual dependence between navies and shipbuilding (and, by extension, the component manufacturers feeding the shipbuilders)."**[51] Major private yards from the early Meiji era were Mitsubishi, Kawasaki, Uraga and Ishikawajima, joined a few decades later by Mitsui and a few others. **Four of these remain major shipbuilders for JMSDF as well as for global merchant marine lines to this day**! An example of the battle- cruiser *Kongo* (now spelt *Kongou* in her latest incarnation in the JMSDF) whose keel was laid in Britain in 1911illustrates many important attributes of Japanese astuteness and determination. This is discussed in the next section.

The *Kongo* Template[52]

Buy One, Make Three! The RN's induction of the *Invincible*- class battle cruisers led to IJN also wanting four that would be better than the British versions. The British however, soon built a much larger battle cruiser HMS *Lion* at an impressive 26,270 tons. The IJN quickly revised its proposal and asked Vickers to make the *Kongo* at 27,000 tons displacement. Vickers at Barrow thus launched *Kongo* in record time in May 1912. IJN had made its decision to build the other three in Japan. The *Hiei* at the Yokosuka Yard (the yard was built in 1865 with French help, it may be recalled) mainly with imported materials; the *Haruna* at Kawasaki, Kobe; and the last, *Kirishima* at Mitsubishi, Nagasaki. **These two were built with almost entirely Japanese materials**.

Significance. The Kongo was the last capital ship built in a foreign yard. The decision to **cut umbilicals with British yards must not have been an easy one, least so because Britain was an ally and had become accustomed to Japanese orders**. Secondly, Japanese navy/ private yards had not built such large ships. Thirdly, there was the problem of material sourcing and imports from Britain. Fourthly, the IJN had asked for many modifications especially in the up-gunning of calibre to 14- inch from the British 12- inch guns. The distribution of three ships in three yards seems somewhat inefficient. However, there were good reasons for this. Among them:

- ✓ The ships were built faster since more dock space, work force and wharfage was available.
- ✓ The overall cost may have been higher than building them in sequence in one Yard. However, time is often the biggest saving in costs and this did happen. It is also quite likely that these were built at an overall reasonable

[51] Daniel Todd and Michael Lindberg, *Navies and Shipbuilding: The Strained Symbiosis* (Westport, Praeger,1996) viii The preface also has a brilliant analogy of the Nautilus of Jules Verne fame as a demonstrator for the way in which shipbuilding turned out to be an aggregating business and Captain Nemo as the aggregator.

[52] This section is derived from *Kaigun;* Allessio Patalano, *Post-war Japan as a Sea Power*; also, Peter Hore, *Battleships* (London, Lorenz Books, 2005). Substantial inputs are from *Kaigun*. Inferences are this writer's.

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price and perhaps cheaper than if supplied by Vickers as a four- ship order.

- ✓ Further, there was a much quicker ramping up of skills in three yards that would subsequently use them for other ships. Would it be wrong to say here that it must have been more than a mere coincidence that three of the four of the JMSDF's current Kongou class DDGHMs were again built at the Mitsubishi Nagasaki yard in the 1990s?

- ✓ It gave the Navy ministry and staff the education required in managing a large project in time; in sourcing materials quickly; in identifying local major and ancillary suppliers.

- ✓ It contributed handsomely to "Skill Japan" that led to confidence in building aircraft carriers, converting some battle cruisers to battleships or other battle cruisers and battleships to aircraft carriers.

Conversion Refits of the Kongo Class. It might be useful to see how and why the IJN converted Kongo to a battleship (BB) and how the overall confidence enabled them to take on some very interesting role- changes or major capability/ survivability alterations to their ships and submarines. In all these endeavours, the Navy's Technical Department was enmeshed with its own and private yards; with research labs regardless of ownership; and with its own Naval Staff to incorporate rapid changes needed **in a period wherein the technology- strategy- operations- tactics dynamics and hence force structure reviews required alacrity from all**. However, it should be understood that there were shortcomings in decision making due to incomplete understanding; turf issues within the IJN; shortage of money; tightening of technology denial regimes even with the British who had been close partners; and, increasingly, resources as Japan's isolation became sharper.[53] Of note, the Japanese were willing to experiment and learn from their errors at least in the context of hardware. The confidence for modernisation refits that led to the Kongo class transforming into battleships had actually evolved through rapid design changing ability that the Navy and private yards had developed and due to the industriousness that could now be taken for granted. **The limitations imposed by the Washington and London Treaties resulted in impetus for far more inventiveness, improvisation and innovation. In India, two organisations that would understand this inventiveness better would of course be the Atomic Energy Department and the Indian Space Research Organisation that have both operated in technology denial regimes of severity and the urgency to achieve a high level of self-reliance for important national purposes.** (In

[53] *Kaigun*, 176: "With the tightening control of information concerning warship design by the British during the war (despite the IJN's cooperative deployments, we may note), the Japanese were forced back on their own designs and spent much of the rest of the war experimenting with hull forms, and bridge, torpedo tube and ordnance arrangements." **The Indian experience of very little design information beyond what is necessary for build- to- print ship or submarine and aircraft building may be both a combination of technology denial by the supplier country/ company, inadequate demand- side pressure for enabling absorption of technology and, in this author's opinion, the absence of a roaring fire in the belly for ultimate indigenisation.**

other words, they had fire in their bellies" of an intensity that in the case of our Services, MOD/DDP, DRDO was nowhere as intense and sometimes, just not there.) The IJN, thus accumulated significant capabilities by modernisation such as modifications for oil- burning instead of coal or coal- plus oil mixed boilers. Treaty restrictions necessitated lighter alloys for armour protection, better designed bridges, mast and funnels; improved bombs and longer range torpedoes. "While they could and did construct new classes of warships, it was cheaper, in a time of leaner naval budgets, to refit and reconstruct existing naval units to deal with or take advantage of these developments."[54] Alterations and Additions (A's & A's in Indian Navy parlance) included major changes to ships like increasing gun elevation in heavy turrets for greater range; anti-torpedo armour; seaplane launch catapaults, deck armour, etc.[55] The Kongo class went through two modernisation refits, during 1927-32, and again in 1933-1940. They got improvements to their "**Float & Fight"** via deck armour, lengthening and reshaping of stern, increasing gun elevation to as much as 43 deg to give greater range with the same calibre, addition of torpedo bulges and for launch/ recovery of float planes, improved Japanese fire control for main batteries and torpedoes . "**Move**" included new Kampon boilers and turbines of indigenous manufacture that doubled power and speed increased from 26 to 30.5 knots.[56] **They became virtually new ships of a different class after the second refits.** Private yards played important roles in converting smaller ships like light cruisers and destroyers as well as submarines to have greater capabilities. **They also leveraged their merchant ship skills to convert some into carriers and other types of warships including auxiliaries. Thus, it can be seen that major conversions of ships in all aspects, Float- Move- Fight requires, and benefits from, all the skills required for constructing new ships but often is achieved at a lower cost. Put another way, major refits benefit shipyards as a way of spreading load onto their infrastructure, investment and people while reducing load on government budgets.**

Submarine Construction in IJN

It was really as a consequence of the First World War that the IJN determined to use submarines actively for its future Pacific strategies. It had cooperated with Britain in this regard and set up a submarine school in 1920 at Kure and soon thereafter the First Submarine Division was formed under an intrepid officer, but not qualified as a submariner, Rear Admiral Suetsugu Nobumasa.[57] Initial construction was on a British design "K class" and had long legs at 20,000 miles. However, engine defects disappointed the IJN. Fortuitously, as reparations, it received via Britain, seven German U-boats. Of these, five were of modern design. These were minutely studied by Japanese engineers and architects. **They "provided vital data from which to design new and formidable classes of**

[54] *Kaigun*, 245.
[55] Ibid, 245.
[56] Ibid 276.
[57] Kaigun, 214.

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submarines."[58] IJN quickly sent many officers to Germany to study U- boats carefully and to obtain access to optical technology for periscopes. According to another account, around 800 German technicians, engineers, U boat crewmen of Weimar Germany were brought to Japan to help in kick- starting construction of truly modern fleet submarines.[59] Submarine construction in Japan had some distinguishing features which are briefly discussed below:

- With long range as an important requirement, the KD-2 launched at Kure Arsenal in 1922 was already better than many USN boats in terms of surface speed and range. Follow-on boats were much improved and built from 1924- 1939.

- Kawasaki built even better J-class ocean cruisers based on the German U-142 class built by Krupp. They had an astonishing 24,000mile range and endurance of 60 days.

- While experts from Germany helped, the same philosophy that guided all government organs about foreigners applied here as well. "**During the first two years of their contract (with Kawasaki), the (German) engineers bore the brunt of the preparation of the working drawings of the submarines. As various submarines were completed, however, Japanese staffs gradually took over the work, until a finally distinctly Japanese type of submarine was evolved."**[60]

- Work on submarine diesels also proceeded well and from largely imported engines in 1920s.By 1930, indigenously designed, improved versions were going to sea. It was "double the horsepower for engine weight when compared to four-cycle, single- acting engines in US submarines…but were more difficult to maintain."[61]

- Submarine munitions capitalised on surface ship and aerial torpedo developments and during WW II some very good torpedoes were deployed by the IJN in all dimensions.

- Innovative usage of submarines was envisaged. They were built/ modified to carry scout planes for reconnaissance; with fairly large calibre guns, and as logistics boats in the later stage of the war. **While the ultimate benefits are questionable, and their strategy of submarine operations quite flawed, the innovations demonstrated technical expertise, resolve and ability to do so quickly.**[62]

[58] *Kaigun*, 215.
[59] David W. Grogan, *Operating Below Crush Depth: The Formation, Evolution, and Collapse of the Imperial Japanese Navy's Submarine Force in WW II* (Kindle edition) p 18, location 355.
[60] *Kaigun*, 217.J
[61] *Kaigun*, 216.
[62] Based on Evans, *Kaigun* and Grogan, *Crush Depth.*

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➢ Today, the JMSDF continues to produce quite large and modern conventional submarines that are built at the Kobe yards of the very same Mitsubishi and Kawasaki companies. **Skills can be part of not only a nation's but also a company's "DNA" in a sense, the devastation of WW II notwithstanding.**[63] While on the subject of skills never going waste, Takashi Nishiyama has authored a fascinating book (2014) in which his deep research into Japan's engineering education and skills and achievements especially in railways provides fascinating insights. He delves into the technical achievements and methods used by Navy and Army engineers to build Japan's war machine from the beginning of the Meiji era and into the Showa period. **In the final three chapters he examines how these demobilized engineers helped the modernization of the railways right upto the Shinkasen in 1964. While it is a great story, the real lessons are that skills never go waste if they are utilized well; that technical skills in armed forces are necessary and are not, as is often believed in India, antithetical to "soldiering", but may indeed improve soldiering itself.**[64]

Yards Constructing IJN Warships in 1941

A tabular review of Japanese Yards would be helpful at this stage having covered the role they played in forging the IJN. The Navy had four construction and refit yards at "Yokosuka, Kure, Sasebo and Maizuru (a fifth, at Ominato, only handled repair work) and eight commercial yards. Private yards had played a major role in Japanese naval construction since the late nineteenth century. **Their prime position stemmed from the Japanese navy's consistent support of the nation's commercial yards as a vital strategic industry."**[65] In 1941, when Japan went to war with the United States, the yards were making classes of ships as follows:[66]

Shipyard	Warship Category
Navy Yards	
1.Yokosuka:	Battleships, Fleet Carriers, Heavy Cruisers, Submarines
2. Kure :	Battleships, Heavy Cruisers, Submarines
3, Sasebo :	Light Cruisers, Destroyers, Submarines
4. Maizuru :	Destroyers, Submarines

[63] Stephen Saunders, *Janes Fighting Ships , 2013-14(*UK, IHS, 2014).
[64] Takashi Nishiyama, *Engineering War and Peace in modern Japan, 1868- 1964* (NY, John Hopkins Press, 2014). This is part of the John Hopkins project on the History of Technology series.
[65] *Kaigun*, 361.
[66] Adapted from *Kaigun*, 362.

Private Yards

1. Mitsubishi (Nagasaki): Battleships, Cruisers
2. Mitsubishi (Kobe) : Submarines
3. Mitsubishi (Yokohama): Special ships
4. Kawasaki : Carriers, Cruisers, Submarines
5. Ishikawajima : Destroyers, smaller craft
6. Uraga : Destroyers, smaller craft
7. Fujinagata : Destroyers, smaller craft
8. Mitsui : Submarines, smaller craft

In terms of distribution of work, 59 percent of 1,794,000 tons was privately built between 1926 to 1945 and 41 percent was in Navy yards. This was a double-edged sword because merchant ship construction by private yards slowed to a trickle and had a telling effect on Japan's ability to wage war against a logistically powerful enemy like the US. A reader should also consider that most of the major belligerents in both world wars continued to construct ships either wholly or partially in government/ navy shipyards. This continues to have merit even if many of the same countries now depend wholly or predominantly on the private sectors for construction, maintenance and modernisation.

Integrity as an Ever- Important Factor

Overall, any student of the Japanese attribute of "bending adversity" whether consequent to major earthquakes (for instance, the 1923 major quake which affected, among other things, Navy yards and private shipyards); or the indomitable morale until a few days before the final surrender in 1945; or the response to tsunami and nuclear accidents of recent times, would not be wrong to **underscore the importance of the sense of discipline and the pervasiveness of resolve and integrity in their society and organs of governance. Corruption, therefore, is more difficult to imagine.** Indeed, in the story we examine in this paper, this was largely true but with one major exception. It concerned the very same Kongo class that has been extolled in earlier sections of this paper.

"The Siemens/ Vickers Affairs" & the Fall of a Government. In a coming together of internal disgruntlement within a collaborating firm, intrepid reporters in England and in Germany, as well as broken promises in payment of "commissions", information was leaked about "a scandal involving naval (and civilian) officers (in the Navy Ministry) of high rank who were found to have received a rebate on a cruiser and wireless equipment purchased by the Japanese Navy from the German firm Siemens. The 'Siemens Affair' was followed by a similar scandal of greater magnitude, when it was disclosed that Mitsui Busan had bribed naval officers and a few civilian officials to make sure that the Navy would order a battle-cruiser, Kongo, from Vickers of Britain. **As the Diet decided to cut the government budget of the Navy, Admiral Yamamoto Gombei**

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(described earlier) resigned (as Prime minister) in the spring of 1914."[67] Apart from the PM and Navy minister resigning, and the government falling, one vice admiral, a few other officers and some civilian officials were court-martialled and tried in courts and jailed. Peter Lowe quotes some British foreign office archives that suggest that Army corruption was much higher but did not surface. It was the start of the First World War that prevented the cancellation of the Kongo "buy foreign, make in Japan" programme since construction was well underway in Japanese yards. But it did cause the IJN's corps of officers a lot of shame but with salutary effects as a result. The Navy was shaken because political parties in the Diet accused its leadership of wasting the nation's wealth through their personal greed or their slackness. Younger officers felt let down by their leadership, even if the numbers of corrupt officers was not high. It harmed the overall standing of the Navy in popular imagination. As a consequence, the officer corps went through some degree of catharsis that improved the integrity of later generations of naval officers. Ultimately, the IJN and Japan benefited from subsequent low levels of corruption.[68]

Profits as a Motive but Deferred Profits as a Necessary Step

Some of the companies that participated in the military side of "Make in Japan" were already in the engineering business and, to some extent, had technical capacities and capabilities that could be turned in another direction. However, they did not always have deep pockets. Moreover, some of the companies that formed later, especially in aviation, or in optics, etc, were what could perhaps today be called "start-ups". **Profits did not seem assured and certainly not in the short term in most cases.** Neither were the volumes to be such that the order books would be full. As seen earlier, this required companies to have patience and dual capabilities; enterprise-level training as well as R & D to not only do what the IJN asked them to, but come up with products that the navy might genuinely want. But, what about profits? The quote from Mitsubishi's leadership about "public interest" did drive companies. It underlines the fact that patriotism is not only a government's virtue but also a peoples' virtue. Pilling could be quoted here because the acceptance of deferred profits worked well even in the early years of the Meiji era as it did after 1945. In a good analysis of Japanese companies, Pilling quotes an American consultant, "***The fact that companies were not beholden to their shareholders, in his view, enabled them to play a longer game…Profits are for now or later. Westerners want their profits now. Japanese want growth now and profits later."*** Pilling continues, ***"That view enabled Japanese companies, liberated from quarterly earnings targets, to prioritise market share…From steel and shipbuilding to cars and semi-conductors, that is exactly what they did***."[69] Andrew Gordon, in his important work on Japan, makes a similar point about the large

[67] Tsushichi Tzusuki, *The Pursuit of Power in Modern Japan 1825-1995* (UK, Oxford,2000)188.
[68] Peter Lowe, *Great Britain and Japan, 1911-1915: A Study of British Far Eastern Policy* (London,Palgrave McMillan, 1969), p 170 and J. Charles Schencking, *Making Waves: Politics, Propoganda and the Emergence of the Imperial Japanese Navy,* 1868- 1922 (Stanford, 2005),pp. 191-200.
[69] Pilling, *Bending Adversity*, 91.

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conglomerates, the *zaibatsu*: " Japan's economic growth thus depended on a dynamic mix of state and private initiative. In parallel fashion, the ethos of the business elite mixed ideals of service to the nation with a drive for personal wealth. Japanese capitalists, like state bureaucrats, did not exalt the creativity of the market pure and simple. Neither did they laud the untrammeled pursuit of profit as the ultimate social benefit. Rather, they drew on Confucian language to put forward a philosophy of what might be called 'selfless' profit seeking." [70]

Globalisation for Trade; Indigenisation for Defence

The Japanese case for their Imperial period shows that protectionism is a reality and a requirement for defence industries. It has been so and will continue to remain so even and perhaps especially in the case of the United States. Various laws and other provisions mandate this and the exceptions to these are in very insignificant areas where imports are permitted. The oft-cited examples of Rolls Royce North America and BAE as exceptions, in fact, reinforce the rules. **Many of the larger powers are, and understandably so, unabashedly protectionist in the defence sector. Even under the ambit of a close alliance like the ones between the US and UK or US and Japan, this is clearly seen**. The early steps taken by the IJN recognised this reality and **sought to leverage foreign assistance to the extent that it could be leveraged on its way to *jiritsu* (self-reliance)**. The way in which the Japanese Self-Defence Forces have leveraged close cooperation with the US and license manufactured much of the "Move and Fight" hardware while designing and developing their own hulls for ships and submarines brings them to a readiness level for a second stage of *Jiritsu* should they so desire and should the overall strategic situation enable/ dictate this to happen. **(It is often said that Japan is just a screwdriver turn away from many things. This paper partially illustrates why this may be correct and what brings them to this stage)** Many of the platforms that form the "float/ fly/ drive" categories are also being increasingly designed and developed in Japan. **This underscores the long-standing tradition in Japan of what we may perhaps call "Japanese Designed, Developed and Manufactured" after the long- overdue "Indigenously Designed, Developed, and Manufactured" (IDDM) category in the new Defence Procurement Procedure 2016.**

At the Same Time, Some Don'ts!

This study also demonstrates some areas where the Japanese examples illustrate some pitfalls.

Too Many Classes of Ships Can be Bad The differences in approaches between US Navy programmes and the IJN's was that the American navy produced more numbers per class thus obtaining savings in design and development efforts and costs; production savings; spreading production of the winning class across

[70] Andrew Gordon, *A Modern History of Japan*…, p 99.

Yards. The IJN did do some of this especially in spreading orders among competing private yards and its own**. However, had it built fewer classes of ships, they could have built more with the same resources**. Evans analyses the example of destroyers, but this applied to battleships, carriers, cruisers and even submarines and aircraft that the Japanese built. The numbers per class in the US increased steadily with Benson- class at 32 (1937-1940); Livermore class at 64 (1938-41); Fletcher-class at 119 plus 126(1940- post WW II). The US built 502 destroyers in seven Navy and twelve commercial yards. Japan produced 177 destroyers of more classes between 1921-1945. Consequently, the numbers per yard were also lesser on an average at just 5-6 hulls. Also, unlike the American insistence on greater standardisation of "Move" factors, the IJN had greater diversity in propulsion plants.**The USN could issue one SOP for steam plants of 321 destroyers of different types.**[71] (Analogous to the IJN, the Soviet Navy, in the post world-war period, also had a proliferation of ship and submarine classes within the same role definitions. While some of the equipment for float and fight was standardised across classes and even types, there was a wide spread in propulsion plants (move) and too many design variations in float aspects.) It can be said that the Indian Navy, or for that matter, even the Indian coast Guard, have had more than the necessary classes of ships over the years. While the IN has taken some steps to build more numbers of one basic design, it is by no means enough.

Accidents Due to Design Flaws. There were some instances where the enthusiasm shown for newer designs and in increasing the overall combat power of several types of ships, resulted in accidents, some very severe. One senior naval architect, Captain Hiraga had already made a mark by making IJN ships lighter to comply with Treaty restrictions on displacement yet with adequate firepower. But he objected to pressures in the case of the *Furatka* class cruisers in the topweight that would be added by too many torpedo tubes.[72] Nonetheless, the issue of topweight plagued many designs and led to stability problems as increasing equipment got installed on the superstructure and masts for fire control, sensors and anti- aircraft guns. **One torpedo boat, *Tomozuru* never recovered from a roll in heavy seas in March 1934. In the introspection that followed, the chief designer, Rear Admiral Fujimoto resigned. However, Admiral Kato Kanji of the Navy General Staff, who had insisted on addition of capabilities, was not blamed![73]** Similar problems once again resulted in many deaths and damage to many ships of the Fourth Fleet while riding out a typhoon. The bow sections of two destroyers broke off but they did not sink. Apart from the typhoon, many design flaws came to the fore. Ships were modified and some new ones under construction were redesigned and hence delayed. **Ultimately, all this had long-term impact on the force availability during Japan's decision to go to war in 1941**.[74]

[71] *Kaigun*, 366- 370.
[72] *Kaigun*, 225-226.
[73] Kaigun, 242-243.
[74] *Kaigun*, 244-245.

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Build an Effective Force Structure, Not a "Comforting" One. The IJN, like other navies of their time, had a combination of conservative admirals as well as future- thinking ones. In some ways, in IJN, the battleship lobby retained the upper hand even when the crying need was to have built more carriers and submarines. **Valuable resources in terms of money, steel, design and development effort, yard space, men, were consumed in very capable, innovative battleships that although better than any others, did not really influence any battles or operational/ strategic outcomes.** These varied resources could have been reassigned to carriers, destroyers, more submarines, tankers and certainly merchant ships. **It mirrored the errors that Hitler and some of his admirals made with the "Z-Plan"** that diverted planning, R & D and material resources. **The realities of what would be an effective navy as opposed to a "desired" navy that imitated others, resulted in scrapping the plan just after it got started. Force- structuring, requires a dispassionate analysis of what might work for tomorrow's threats at the operational and tactical levels so as to achieve possible future strategic objectives that take into account current and developing threats of tomorrow's possible adversaries. Logically, the optimisation has to be done considering the larger spectrum of warfare.** The IJN's example at the strategic and operational provides a good case study for this conundrum.

Conclusions

In a sense, this story about the Imperial Japanese Navy does not really have a happy ending from the viewpoint of their nation during the Second World War. **This does not however, diminish the value to us today for the lessons or pointers that have been drawn out in the sections above.** While templating all the steps taken by the Japanese governments, or the IJN and their shipyards in the public as well as private sectors may not be advisable, this case study provides us adequate justification for some of the steps that have been taken in the recent past and some pointers for what more could be done. These are summarised below.

Japanese resolve from the earliest years following the Meiji Restoration in 1868 for ***Fukoku –Kyohei*** (Rich Country, Strong army) and the quest to be counted as a great power, provided themselves with a **sustained over-arching vision**. In turn, this "**fire in the belly**" enabled them to take this exhortation **from a slogan to concrete policy formulation and implementation all through.**

The early realisation that *Jiritsu* (self-reliance), for all needs of the Army and Navy was necessary, facilitated the leadership in setting the IJN on the right path. In 1868 or even in 1880s, **Japan lagged behind even colonial India** in many parameters including technical infrastructure, education, railways, etc. Neither was it a rich nation. **Perhaps the corollary to it never being too early for achieving *Jiritsu* in defence hardware, is that it is never too late to achieve "*swavalamban"* either.**

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The methods in which Japan and the IJN interacted with foreign governments, navies, companies and experts needs to be comprehensively studied and adapted to our times with greater focus. Just as their interactions led to tangible and steady attainment of the "make in Japan" goals they set for themselves, **Indian entities, public and private companies must also leverage these very associations for Indian gain.** It would be appropriate to remember that most foreign partners who have been associated with defence hardware needs for India have themselves been essentially self-reliant or have become nearly self-reliant for some decades. **Why should India be bashful about this goal?**

Technology denial "regimes" have perhaps existed for a very long time in some form or the other. The IJN's and Mitsubishi Nagasaki Yard's experience above was not, nor will remain, unique. **What is denied but needed would need to be designed and developed**. Like the *de facto* "JDDM" examined in this paper, **"IDDM" for India is the ultimate way to reach a sufficiently high level of self-reliance and must be the prime source of future needs.**

Consequently, **transfer of technology is predicated not on the willingness of the supplier to so transfer**, since most often this brings no great advantage to the foreign government or its companies to really do **so, but on the "demand" side insistence on such transfers.** For this to happen, the receiving country has to have the ability not only to absorb the technology, but to proactively and robustly set about doing so. **Further, the tendency to exaggerate licensed production or partial manufacture of some hardware as transfer of technology should be avoided at all costs**. In India, we often fall to the temptation to overplay the indigenisation. Depending on the circumstances, the Services, DRDO, DPSUs and even private entities sometimes indulge in this. True indigenisation is absolutely required and must be achieved. However, a 'spin" is hardly helpful. Likewise, improvisation (often just "jugaad") is exaggeratedly portrayed as innovation. Improvisation is sometimes barely improvement and never innovation. As demonstrated by the IJN, licensed production/ build- to-print ought to lead to very high "made in India" percentage of each platform/ system in "make in India" production with foreign partners. Where necessary, every leverage in India's interest must be deployed for genuine sharing of information and for TOT. **Ultimately, absorption of technology rather than TOT is what enables technology transfers**. Indian private and public companies involved in defence manufacturing should, therefore, ***want* to absorb technology**. **This would be a smarter business model because it would be the prime path to these very companies becoming exporters of IDDM rather than remaining facilitators for foreign companies to continue to "make and make even more" in India.**

Indigenisation has to be assessed via more meaningful parameters such as:

- **Criticality of technology** to overall effectiveness of the hardware.

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- A long-term view on overall money saved. In the short term, it would often be necessary and **worth the while to indigenise even if at a higher cost**.
- **Import substitution** of raw materials, tooling, forgings, etc.
- **Assured value addition through technology absorption**, production of improved versions and collateral benefits in other areas. Also, in terms of jobs created/ foreign specialists sent back, skills achieved etc.
- **Ability to move from being in the global demand chain to creating a valuable space in the global supply chain for "defence solutions".**[75]

A ship or submarine has to be seen as a composite and integrated system with **float-move-fight attributes that all need simultaneous attention and indigenisation**. The IJN's efforts in this as well as in aviation for **fly- move- fight attributes,** was nothing short of extraordinary. **Only if India demonstrates the ability to satisfy herself in all these areas, will our public and private companies together be able to enter the global demand chain.**

To achieve the above for herself and for our friends elsewhere, strong **partnerships between public and private defence firms would be very necessary**. In the US, Japan, UK, France, Soviet Union, their government owned yards were critically important for a long time. **The government can pay a higher price, absorb losses for achieving self- sufficiency, or have occasionally idle infrastructure if inescapable, but private firms cannot do it as easily**. **India's quantitative requirements may also be such that retaining DPSUs would always make good sense.** The issue of lack of sustained orders has, in any case, been a major reason why so many aerospace and other defence firms have experienced so many mergers and acquisitions.

While global trade regimes as also economic wisdom often make protectionism difficult and/or disadvantageous, **the defence trade is largely protected by those that hold the keys.** Japan protected its shipping manufacture through tax and import- protection in the 19-20th centuries; encouraged switching between naval and commercial shipbuilding. **Many "supply" side governments zealously protect their defence firms against imports in key areas while pushing exports**. Japan did this for its naval ships, ordnance and commercial ships during WW I while doing everything it could to wean itself off defence imports as shown in this paper. **Quite obviously, defence trade—if it can be called that-- would remain fundamentally different from general global trade.**

A key area where we can, and must, take a leaf out of the IJN, is in indigenisation and innovation of ordnance. They made good progress in all types of shells including innovative underwater trajectory against battleship armour, advanced explosive compounds, and really long range, high speed torpedoes (the Type 91) and air delivered ordnance. They became early

[75] This is based on this writer's contribution as a key researcher and team member and primary drafter for an earlier report on indigenisation of the aeronautics sector. The leader is a renowned expert in the aeronautics sector.

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exporters but cut back when their own needs overwhelmed them. Their case shows that while they achieved qualitative levels, they were short of ammunition almost throughout the Second World War. **Indigenisation and further development of all types of ordnance including missiles and other smart munitions could be accorded the highest priority. Few "coming wars" have ever been short ones with any assurance of victory in any case. Ordnance, therefore, has quantitative needs that provide qualitiative value. It is the fuel of warfighting and at the tactical level, and many, if not most actions in combat require either side to "break things and kill people" no matter how uncomfortable this may sound.**

Developing human resources via national and enterprise-level education and training is the key to developing defence sector skills. **The users' skills while wearing the nation's military uniform has to be matched by the engineer, technician and worker wearing overalls while "making in India" in Yards and factory floors.** The Japanese efforts at dynamically enmeshing government, university, polytechnic, IJN, and company levels were truly noteworthy and we must emulate them. **Implementing "Skill India" would become a long-term investment and contribute to profits beyond the horizon**. One just has to see the way Japan (or Germany) rose from their devastation and "bent adversity". It was the skills that they had built assiduously in the inter-war years and even before the First World War that enabled their revival and a seat once again at the high table. Our armed forces would need to be more technicalised. It needs to be understood from earlier as well as modern military experience of many countries that technicalisation of manpower helps and is most certainly not antithetical to warrior values, tactical proficiency or fuzzy definitions of soldiering. Technology and tactics go hand in hand and one always benefits from the other.

Related to the above, the efforts put in at the same levels, including by Mitsubishi in applied R & D, points to the need for even more companies to look at R & D as a totally required input- cost to generating products as well as profits. The point cannot be over-emphasised.

The IJN's path was perhaps unique for its time, but its efforts at self-reliance, and national efforts at skill building are reflected in many steps taken by China and the Chinese Navy.

On profits itself, Japanese companies and their national ethos often showed the way for Japan and could do the same for us. Could Indian companies think of "Growth now, profits a little later" as did the Japanese? Perhaps we can; certainly we must.

The lessons of history have shown that it is ill-advised to build the Navy one can as opposed the one that would serve our future purposes best. Internal turf- sensitivities, even romantic notions, and failure to dispassionately imagine

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operational and tactical level dynamics stymied not only the IJN, but the US, British and German navies. Precious resources in men, money and materiel were poured into increasingly capable battleships that largely became increasingly ineffective as offensive combat platforms in the face of threats from the torpedo and the bomb. What if the IJN had devoted these resources to more submarines, carriers, airplanes and tankers? Ironically, the Hitler's Navy pushed in resources into an aircraft carrier before cancelling the investment. They recovered some of the investment, but how does a navy recover lost time? What would be the contours of a naval force structure for each country that would better serve its own needs in a future that is always going to be foggy and fuzzy? Therefore, what should be thrust areas for indigenization, for imports if they are inevitable and how should skill development, education, training and doctrines at strategic, operational, tactical levels evolve? ***For India, the guiding principle ought to be build what we need, not merely what we can.***

Finally, the Imperial Japanese Navy's story did begin well even if it commenced in an environment of great difficulties. Repeatedly, Japan and the IJN surmounted their challenges and bent adversity. Today, the JMSDF is once more a powerful, modern and expanding navy that endeavours to have ***Jiritsu*** yet again. Japan now pursues a very different, cooperative grand strategy compared to the belligerent aspirations of the Imperial era. But some of the very same resolve shown then seems to influence the JMSDF today. **In that sense, the unnamed Japanese officer quoted at the head of this paper was quite right. We may also acknowledge that even if the IJN's story did not end well, its success at self reliance could inform and influence our own navy's quest for "*swavalamban*"** as the year 2047, a hundred years of our independence, is just over three decades away. The push towards our own ***Jiritsu*** **has acquired an urgency.**

This paper could end by quoting a naval officer who was also simultaneously a member of the House of Commons in England, and later an admiral:

> ***"Japan has within 40 years gone through the various administrative phases that occupied England about 800 years and Rome about 600, and I am loathe to say that anything is impossible with her."***
>
> - Lord Charles Beresford, RN, MP, 1895[76]

Would it not be nice if someone could say something similar about India?

Image Source:

- http://ajaishukla.blogspot.in

[76] Quoted in Andrew Gordon, p.132. Some readers may recall that Admirals Beresford and John "Jackie" Fisher became bitter rivals as flag officers in the RN in the early 20th century.

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