

The Transfer of Technology and Science to Asia 1780-1880: Shipping and Shipbuilding

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The Transfer of Technology and Science to Asia 1780-1880: Shipping and Shipbuilding

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During the century 1780-1880 the relationship between the Western world and Asia turned increasingly critical. One of the central factors in that collision of civilizations was the transfer of science and technology to and/or into Asia. Another was the maritime revolution which played a pivotal role in the creation of the Western-dominated world economic system and the expansion of Western power and influence into Asia as Western ships were the indispensable and indisputable 'instruments' of transport, commerce and empire.¹ As the world's shipping industry went through a process of revolutionary technological change, which was more profound than that of any previous period, these two factors are firmly intertwined. Major stages of this maritime revolution were dramatic improvements in the wooden sailing ship, the use of metal as a ship-building material and, above all, the introduction and diffusion of the steamship which, itself, was continuously being further developed in size, power and productivity.²

It is not surprising that the Western powers often nurtured and fostered their maritime superiority and actively resisted or hindered the transfer of the technology underpinning that superiority. Indeed, as the editor of the proceedings of the first 'Transfer' conference suggested,³ one often has to analyse the 'why-not' question as much as the 'why' question. But, even accepting that for many varied reasons traditional maritime technology could and did survive in Asian waters, in this period of maturing imperialism the inhibiting factors in the transfer of modern shipping and shipbuilding to Asia, at least in the colonised parts of the continent, appear to have been less rooted in the refusal of Asian society to seek

¹ D. R. Headrick *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York 1981) Chs. 9 and 12.

² A modern international history of shipping in this period still remains to be written, but see, e.g., the classic A. W. Kirkaldy *British Shipping* (London 1919).

³ W. G. J. Rummelink 'From the Editor', *Journal of the Japan-Netherlands Institute* III (Tokyo 1991) 6.

the transfer of technology than in the refusal of Westerners to provide assistance in that process.

The article is thus built up around three themes. The first concerns the first sixty years or so of the period and is virtually exclusively concerned with the colonial areas of the various European empires. The second discusses the divergent path taken in the later part by China and Japan by sharp contrast with events in those areas of Asia where the West could wield power. The third major issue, finally, is the comparison between the maritime development of what in historical orthodoxy are seen as the 'winner' and 'loser' in the East Asian powerplay, viz. Japan and China. Because of the cut-off point in 1880, however, there is less contrast in the relative maritime performance of these players than most observers might expect. Although it might be too provocative a question to direct at the overall political efficacy and economic modernisation of both countries, in the maritime sphere one must wonder whether the issue had been decided already so early and so conclusively.

By way of introduction, it must be stressed that the transfer process could be complex and not necessarily linear as Asia, by contrast to the Western world, could not rely on the full scientific, economic and political resources which were required for a smooth transition from one stage of maritime transport technology to another. Thus the process of interaction between Western technology and Asian societies was often hesitant and fluctuating. Moreover, many kinds of interaction existed such as the permanent introduction of Western ships to Asian waters; the transfer of control and/or ownership of such vessels from Western to Asian businessmen or governments; direct access by Asians to Western sources of such vessels instead of relying on the local purchasing of, inevitably, second-hand and often lower-quality ships; the repairing and/or building of such Western ships in Asian shipyards; giving Asians access to the relevant Western technology and/or scientific knowledge through training and/or education in Western yards or institutions; and, finally, the establishment of such training and/or educational institutions in Asian countries. While artisanal skills, for example, were largely sufficient for the transfer of wooden ship-building, the development of the sea-going steamship relied increasingly on scientific research and development.⁴ The following, inevitably highly succinct, overview will attempt to sketch the process of transfer of modern maritime transport technology to Asia. According to the two major types of Western maritime technology, first the sailing-ship and then the steamer will be discussed. At several instances it will be important to consider the naval dimensions of technology transfer as well.

⁴ See, e.g., John Guthrie *A History of Marine Engineering* (London 1971).

But first several general observations should be made. First, maritime Europe knew an almost limitless variety of sailing craft, many of which never emerged from relatively narrowly defined geographical niches. Only a small number of classes, naturally almost exclusively the larger, sturdier and seaworthier categories, ever ventured beyond the Capes to Asian destinations. These were, above all,⁵ large three-masters (at first square-rigged on all masts but later also barques) and to a lesser extent smaller two-masted brigs and schooners which sailed to and in Asian waters. In consequence, it was these types which were available as models for imitation by Asian-based shipwrights and for purchase by Asian owners.

Asia, it cannot be stressed enough, had at least equally strong maritime traditions as its European invaders. From Arabia to Japan innumerable towns, villages and bays were the scene of boats and ships being built by thousands, if not tens of thousands, of shipwrights and carpenters. Even if their products generally could not match the best Western vessels in sturdiness, capacity and performance, Asian ships were as varied and as ingenious in design and construction. From the viewpoint of this paper the crucial condition was that in both cultural regions the building of wooden ships was an artisanal form of production in which the fundamental professional requirements were still largely comparable. Initially, political domination by the West, be it Britain, the Netherlands or Spain, gave considerable stimulus to such transfer of technology before colonialist policies snuffed out the industries thus fostered.

But from the late eighteenth century the Western ocean-going sailing-ship went through a significant process of development, tonnage growth and productivity increase which ultimately resulted in the clipper and the sailing tramps of a century later. Much of this process was caused by changes in design, much also by the adoption of new materials. In particular copper, for sheathing and fastening, and iron, for rigging, found widespread adoption. While there were ample resources of suitable shipbuilding timber in South and Southeast Asia, other materials often had to be imported at high expense from Western sources. More importantly, with the diffusion of non-timber-based technology, which required altogether different skills, there arose real questions whether under these conditions Asian shipbuilding by imitation could be sustained.

These issues became decisive when metal was used for the frames, hulls and masts of ever larger sailing-ships. Such technology could only be sustained

⁵ See J. R. Bruijn et al. *Dutch-Asiatic Shipping in the 17th and 18th Centuries I* (The Hague 1987) 39-41, 50-51 and 55; Ingrid D. Dillo *De nadagen van de Verenigde Oostindische Compagnie 1783-1795* Schepen en zeevarenden (Amsterdam 1992) 53-54 and 72-73, on other types such as fluyten and hoekers chartered and bought by the VOC during its last years.

by shipyards with highly skilled labour forces and possessing all appropriate tools and sources of supply. It is difficult to see how such yards could exist at centres other than those located at or near modern metallurgical industries and that meant the West. The same applied with even greater force to steamships once the initial stage of fitting imported engines into ready-built wooden hulls was abandoned. Although several dedicated repair yards were established in a number of mostly colonial Asian ports, it was not until the independent governments of China and Japan, following the example of many European nations in a concerted strategy of developing modern navies, embarked on—primarily naval—shipbuilding policies that an indigenous Asian steamship and engine-building industry could emerge. Ironically, again, the pressure of the times was such that, after a promising start, both East Asian countries switched over to policies of buying abroad, thus creating another series of sharp discontinuities.

But for the development of modern Asian merchant shipping the existence of local shipbuilding, however important that could be, was not an absolute prerequisite. At various times and places, active second-hand markets existed for sailing-ships and later also steamers where Asian businessmen could purchase tonnage on the spot. Even if this, well-nigh inevitably, pushed such owners of less-than-new tonnage into the lower echelons of the freight market, it gave them a toehold into what otherwise would have been a totally Western preserve. That sufficient capital was available for their entry into the steam shipping market is shown by a number of ambitious and determined companies which ordered new tonnage directly from British shipyards.

* * *

The first stage of the transfer of Western maritime technology to Asia involved the wooden sailing-ship. Its diffusion was remarkably widespread, both in the shipbuilding and shipping industries, even if neo-mercantilistic policies of Britain and the Netherlands proved highly detrimental to the former. But the rise of Asian shipyards ultimately proved to be a hollow victory as no economic and educational systems existed to enable local builders to continue to keep pace with overseas builders and, later, to make the transition to the construction of metal hulls and marine engines. Asian shipowners, of course, could and did continue the practice of buying second-hand material from overseas, but their demand was no longer a stimulus for on-the-spot new construction.

The most widespread and spectacular diffusion of Western shipbuilding in our period could be found in India, but the first such ships were built much earlier

for the Spanish.⁶ The demand for galleons in the transpacific trade between Acapulco and Manila was met by a multitude of builders and carpenters, mostly but by no means exclusively Chinese. Probably the greater part of these large vessels was built at Manila and on Luzon, but orders for others were placed elsewhere in the Philippines and, until 1679, even in Siam and Japan. It is not clear whether the leading shipwrights were Spanish and Chinese, but a diffusion of building technique from the royal dockyards to private enterprise is certain to have taken place. This construction took place during the whole of the seventeenth and eighteenth centuries. The example set in the Philippines was eagerly followed elsewhere in Asia once private enterprise emancipated itself from the restrictions imposed by the various East India Companies.

The British capture of Manila, in 1762, may not have had any direct impact but it was symbolic for the shift to the eastern seas which came to characterise the interests of the country traders, the private shipowners and merchants operating under licence from the East India Company.⁷ With a strong acceleration after 1784 a new complexion came over Indian seaborne commerce which created a strong demand for Western-type vessels. Southeast Asia (Penang was founded in 1786), the Philippines, Canton and Australia became regular destinations for private ships from Bengal, Bombay and other Indian ports. With only very few ships being imported from Europe for their use, expatriate British and indigenous Indian shipowners (at this stage occasionally linked in close partnerships such as Carr Tagore & Co)⁸ could not but rely on locally-built tonnage.

Between the 1780's and the 1830's hundreds of Western-type sailing-ships were produced on shipyards all along the Indian littoral. Benefiting from ample supplies of superior hardwoods, especially teak, the best of these easily compared with the highest-quality European ships. Several of the largest and best-known Eastindiamen of the day originated from Bombay which became the premier shipbuilding centre of India. The yard of the Parsee Wadias has almost become legendary.⁹ Even the Royal Navy had warships built there, including the *Asia*, Codrington's flagship at the battle of Navarino. But many other places shared in the work. These included Calcutta with several satellite settlements on the Hooghly and a large number of smaller traditional port towns such as Chittagong,

⁶ This paragraph is based on W. L. Schurz *The Manila Galleon* (New York 1959) 193-200.

⁷ P. J. Marshall 'Private British Trade in the Indian Ocean Before 1800', in Ashin Das Gupta & M. N. Pearson, eds. *India and The Indian Ocean 1500-1800* (Calcutta 1987) 290-300.

⁸ B. Kling *Partner in Empire: Dwarkanath Tagore and the Age of Enterprise in Eastern India* (Berkeley 1976) Ch. 4.

⁹ R.A.Wadia *The Bombay Dockyard and the Wadia Master Builders* (Bombay 1955).

Coringa (near Kakinada) and Cochin.¹⁰ Surprisingly early, too, European-type ships were constructed in Burma, at Rangoon and Moulmein, the main source of building timber for Bengal. Especially the latter port became known for the passenger ships the London shipowner Duncan Dunbar built there as late as the 1850's on his own yard.¹¹ But this was the swansong of the Asian industry.

Although their initial field of employment had been the country trade in Asian waters, India-built ships very quickly gained a footing in the intercontinental trade with Britain. As I have explained elsewhere,¹² circumstances during the French Wars made it occasionally necessary for the East India Company to charter such tonnage. Once the East India Act of 1813 had thrown open the Indian trade to private shipping a direct confrontation between British-built and local tonnage ensued. While the sale of Indian-built ships to British shipowners could not be prohibited,¹³ the exclusion of Indian seamen (the so-called 'lascars') from the Navigation Acts meant that in practice Indian-owned ships were excluded from trading outside Asian waters. In this manner metropolitan interests were able to smother the potential competition from Indian shipyards. When the Navigation Acts were abolished, in 1850, commercial conditions and shipping technology had already changed so much that no come-back was possible.

The spectacular rise of Western-type wooden shipbuilding in India gave unprecedented stimulus to modern shipowning. Significantly, owners included both British agency houses and indigenous entrepreneurs. The latter often operated mixed fleets of native-style and Western vessels. The rise of entrepreneurs like Sir Jamsetjee Jeejeebhoy and others in the Bombay-Canton opium trade was entirely based on their ownership of considerable numbers of the latter.¹⁴ Indian shipyards also exported large numbers of Western vessels to other Asian regions. Probably the best-known of these were the ships ordered by Sultan Seyyid Said of Oman (only one of his vessels was built at Mattrah). Several of his mixed naval-commercial fleet ventured outside the Indian Ocean.¹⁵ But by

¹⁰ W. Milburn *Oriental Commerce* II (London 1813) 174; see, above all, the lists of ships built in India in J. Phipps *A Guide to the Commerce of Bengal* (Calcutta 1823) and *Idem.*, *A Collection of Papers Relative to Shipbuilding in India* (Calcutta 1840). See also Charles Bateson *The Convict Ships 1787-1868* (2nd ed., Glasgow 1969) appendix 1-6, *passim*.

¹¹ B. Lubbock *The Blackwall Frigates* (Glasgow 1928) 245-247.

¹² Frank Broeze 'Underdevelopment and Dependency: Maritime India during the Raj', *Modern Asian Studies* 18 (1984) 434-435.

¹³ Except for the period 1815-1823.

¹⁴ Asiya Siddiqi 'The Business World of Jamsetjee Jeejeebhoy', *Indian Economic & Social History Review* 19 (1982) 319-324.

¹⁵ Oman Ministry of Information & Culture *Oman, A Seafaring Nation* (Muscat 1979) 74-86; see also Patricia Russo *Oman & Muscat: An Early Modern History* (London 1986) 101.

far the greater part of such Indian-built tonnage was sold second-hand. Ready markets came to exist in Penang, the Dutch East Indies and, since 1819, Singapore. Although local shipbuilding industries sprung up in many places, they were never able to satisfy the demand for Western-style vessels once conditions of more or less free trade applied.

This was particularly evident in the Dutch East Indies after the abolition (1799) of the Dutch East India Company (VOC). Although the company itself had been heavily involved in the intra-Asian trade, it had never allowed its Javanese *djati* forests to be used for the building of anything larger than lighters or very small craft.¹⁶ Moreover, its restrictions on private shipowning delayed the development of both maritime industries until well after Indian shipbuilding had come on stream. But the extent of modern shipowning in 1820, the first year for which detailed data are available, strongly suggests that from the turn of the century a powerful take-off took place, in which all ethnic groups participated. On Java and Madura 10,844 last (c. 20,000 tons) of Western-type sailing-craft, were registered. Of these 25.5% belonged to Dutch individuals and merchant firms, against 22.6% British, 21.8% Arab, 16.7% Chinese and 7.3% indigenous (Javanese, Sundanese and Madurese) ownership.¹⁷

Elsewhere I have attempted to analyse and assess the growth of the Javanese merchant fleet until 1850.¹⁸ Here it is sufficient to note that, after a peak in the mid 1840's, its total tonnage then rested at 15,503 last (c. 29,000 tons), a figure which was only marginally higher than that of 1825. The ethnic composition of the collective ownership, however, had dramatically changed. Now no less than 50.7% belonged to Arabs and 28.7% to Chinese (both peak figures), against only 9.6% to Dutch, 9.3% to British and 3.1% to indigenous owners. Evidently, just as non-British entrepreneurs in India had both the resources and the desire to enter the Western or high-quality part of the shipping market, so did many non-European owners on Java and in other commercial centres of the Dutch East Indies such as Palembang, Pontianak and Bandjermassin. In direct competition with European rivals their lower operational cost levels and their involvement in local and regional trade gave them powerful advantages. In particular the Arabs, largely originating from the Hadhramaut, eagerly adopted relatively large Western three-masters and barques for the bulk

¹⁶ Dillo *Nadagen* VOC 80.

¹⁷ The figures in this and following paragraph are based on the annual *Regeringsalmanak* published by the colonial government in Batavia.

¹⁸ Frank Broeze 'The Merchant Fleet of Java, 1820-1850', *Archipel* 18 (1979) 251-269.

transport of goods such as rice and passengers like soldiers within the archipelago or *hajis* on the long haul to Jiddah.¹⁹

The ships for this vibrant new merchant fleet were built in India and on Java itself.²⁰ The capture of Batavia by the British, in 1811, brought the Dutch East Indies within the commercial sphere of India and during the next decade a large number of Indian ships were sold to Eastern owners.²¹ But at the same time the local shipbuilding industry, now free from all shackles, came on stream. Particularly on the northeast coast of Java, at places such as Rembang, Gresik and Surabaya, new yards were established or established yards switched over to the construction of Western three-masters, brigs and schooners. By the mid 1820's a large number of such vessels had been built, mainly in the 80-200 tons range but also several of over 300 tons. These included the *Hunter* which, in 1822, was re-registered in the Netherlands and at least three others which carried cargoes to the Netherlands on account of their colonial (but ethnically European) owners.²² But Arab owners also did not hesitate to order large ships culminating in the huge *Fait Allam* (560 last, c. 1,050 tons).²³ But, similar to what happened in British India, after a few years of complete freedom the competition of Java's shipbuilders and shipowners was thwarted by measures taken by the Netherlands government.

First, in 1819, registration of ships under the metropolitan Dutch flag was only allowed to ships built in the Netherlands, excepting extraordinary circumstances.²⁴ Two years later a subsidy system was introduced for such ships and in 1824, finally, the *Nederlandsche Handel-Maatschappij* was established with the avowed aim of employing only nationally-built vessels at initially exceptionally high freight rates.²⁵ The possibility that ships owned in the Indies, by Dutch or British merchant houses, could continue to operate in the trade between the East Indies and the Netherlands was negated by the interpretation

¹⁹ By contrast, Western-type vessels of Chinese and indigenous owners were significantly smaller and consisted, mainly of schooners (T. S. Raffles *The History of Java* I [London 1817] 203, and, esp., *Regeringsalmanak* [1820-1870] *passim*).

²⁰ There is no evidence of any Netherlands-built ship having been sold to Asian owners during this period.

²¹ See the shipping lists in Phipps *Commerce of Bengal and Shipbuilding in India*.

²² Algemeen Rijksarchief, The Hague [henceforth ARA], Staatssecretarie [henceforth SS] 2286 (4 August 1825) N 103, and 2364 (24 November 1825) N 78; Koloniën 2813 (6 May 1828); and Collectie Baud 234, memorandum by J. Wappers Melis (10 August 1822).

²³ *Regeringsalmanak* (1831); see also G. W. Earl *The Eastern Seas* (London 1837) 71-72.

²⁴ F. J. W. H. Sandbergen *Nederlandsche en nederlandsch-indische scheeps-nationaliteit* (Leiden 1931) Ch. 2, pt. IV, and Ch. 3. J. A. Kok *De scheepvaart-bescherming in Nederland en Nederlandsch-Indië* (Leiden 1931) 4-9.

²⁵ W. M. F. Mansvelt *De Nederlandsche Handel-Maatschappij 1824-1924 I* (Haarlem 1924) 97-98; Kok, *Scheepvaartbescherming*, 16-25; Frank Broeze *De Stad Schiedam. De nederlandse vaart op Oost-Indië omstreeks 1840* (Leiden 1978) 5-12.

which the government gave to its 1822 discriminatory tariff act. After several vessels registered at Batavia had landed their cargoes under conditions equal to those applying to metropolitan ships, it was decreed that such ships, as far as the discriminatory tariff was concerned, would be regarded as foreign.²⁶ Here it was ships' flags, in Britain it was the nationality of seamen. But the purpose of each government was only too clear: where the transfer of shipbuilding technology and Western-style shipping from Europe to Asia was obviously successful and threatened to endanger metropolitan interests, political measures were adopted to counter such threats.

The final chapter of this struggle was written in the 1830's after a Java-built three-master, using the loophole of the 1819 registration act of 'extraordinary circumstances', had been sold to a prominent Amsterdam shipowner. The government in Batavia and the Ministry of Colonial Affairs now proposed that it would be to the advantage of the, at that time, stagnating colonial shipbuilding industry if such sales would be made possible as a matter of routine.²⁷ Caught in the logical paradox of advocating the benefits of such a move for Java and at the same time suggesting that such a move would have no effect on the Dutch industry, the colonial lobby was easily sideswiped by the combined forces of the Chambers of Commerce of Amsterdam and Rotterdam and the various other ministries. Even if the evidence allowed discussion on the point of the relative competitiveness of the Java-built ships, there was no counter to the Dutch colonialist ideology of the time: "... the interests of a colony should not be considered in isolation but in relation to those of the mother country and, should there be a collision of interests, as subordinated to those."²⁸

From all the foregoing it is evident that no significant barriers existed in the transfer of building and owning of Western-style wooden sailing ships to Asia. In particular Indian-built ships were competitive in price and quality. But in the Dutch as much as in the British empire no such enterprise was allowed to challenge metropolitan interests and soon colonial shipyards were effectively restricted to selling in local markets. European expatriates and, more importantly, Asian shipowners were keen to enter a great variety of trade in Asian seas where they were clearly able to undercut European rivals.²⁹ This remained so also after

²⁶ ARA, SS 2286 (4 August 1825) N 103, and 2364 (24 November 1825) N 78.

²⁷ This paragraph is based on the file in ARA, SS 4307, (9 November 1837) N 83.

²⁸ Chamber of Commerce Amsterdam to Administrateur National Nijverheid (26 October 1835) in *ibid*. Through a bureaucratic oversight Dutch East Indies vessels for a few years were allowed to trade with the British colonies in Australia. One of the ships which was employed in that trade was the "superior" *Justina*, "built upon the improved principle laid down by Sir William Symonds, of no hollow lines." (*Sydney Herald* 17 May 1838).

²⁹ See, e.g., *Raffles History of Java* I, 200-201 and 228-229.

Asian shipbuilders could not produce any more vessels comparable with those built in Europe or the United States. As the statistics for the Dutch East Indies after 1850 show, local shipowners remained a force for another thirty years or so.³⁰ Qualitative and quantitative evidence for Singapore suggests a very comparable situation, with only a reverse balance of power between Arabs and Chinese.³¹ In 1866, 178 Western-style square-riggers were homeported at Singapore, of which 58 belonged to European, Malay and Indian owners against no less than 120 to Chinese.³² As yet no analysis has been made of Indian shipowning during the second half of the nineteenth century, but from incidental evidence it is clear that also Indian owners continued to buy such second-hand, but now overseas-built, tonnage until the commercial life of the sailing-ship was coming to an end. Very much the same was the case in Japan once all restrictions on shipowning were abolished.³³ As before, however, such Asian-owned vessels rarely ventured outside the Indian Ocean and East Asian seas. Thus a clipper like the *Sir Launcelot* could spend its last years on the India-Mauritius run.³⁴

By that stage the sailing-ship for long-distance trading was either composite or, more commonly, metal-built. No such vessels, which could measure well over 1,000 tons, were ever built in Asian shipyards. It was, in fact, the transition from wood to metal which locked traditional shipbuilders out of the new industry as artisanal methods were incapable of working with the new material. No colonial government ever supported such a direct technological transition or provided support for the preconditions necessary for the emergence of iron or steel building, including the establishment or promotion of a local metallurgical industry and suitable education and training for a skilled workforce. But, in principle, such vessels could be bought by Asian shipowners as the capital for such investments was available. They did not use that opportunity, probably partly because local yards were incapable of maintaining them and partly because Asian shipowners simply did not conceive of the intercontinental trades as employment for their fleets. To a certain extent, their failure to transfer into metal steam shipping was a voluntary retreat which resembled that of the pre-1780 period, but it was also conditioned by the absence of a modern ship building

³⁰ Regeringsalmanak, *passim*, and the lists in H. Sweys' annual compilation, *De Nederlandsche vloot en rederijen, passim*.

³¹ Singapore, Surabaya and Hong Kong were common places for the sale of used Australian sailing ships; see the colonial shipping registers in Public Record Office, Kew (London), Board of Trade 107, and also a variety of letters written by the Sydney merchants-shipowner Robert Towns in Mitchell Library (Sydney), Uncat. Mss. 307, items 69-71.

³² Song Ong Siang *One Hundred Years of the Chinese in Singapore* (London 1923) 119.

³³ See, e.g., Marius B. Jansen *Sakamoto Ryoma and the Meiji Restoration* (Princeton 1961) 183, and R. Furuta & Y. Hirai *A Short History of Japanese Merchant Shipping* (Tokyo 1967) 110.

³⁴ Arthur H. Clark *The Clipper Ship Era 1843-1869* (New York 1910) 346.

industry. This, in turn, was largely conditioned by political factors as was equally shown in the, far less voluntary, small presence of Asian shipowners in steam shipping which by 1880 had already established itself firmly on Asia's local, regional and intercontinental trade routes.

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The historical development and diffusion of river and sea-going steam navigation in Asian waters has been chronicled in great detail and little needs to be added to that historiography here. Three elements, however, must be highlighted: the vast support given by imperial and colonial governments to Western enterprise and, similarly, by Chinese and Japanese authorities to their nascent industries; the size and market share of Asian merchant shipping and the external conditions which helped to determine that participation; and the miniscule shipbuilding industry which existed in Asia by 1880 (and which was largely naval rather than commercial in purpose and character).

The beginnings of steam navigation in Asia, as almost everywhere in Europe outside Britain lay with merchants who desired a vehicle of quick despatch for valuable merchandise, passengers and mail.³⁵ While the former two were purely subjects of commercial enterprise, government carried responsibility for the latter. After an initial period in which colonial authorities themselves ran steamers in a more or less desultory fashion,³⁶ a symbiosis of government and business was achieved through the adoption of mail contracts which provided state subsidies for private steam shipping companies. This system of mail subsidies had been introduced by the British government in the late 1830's for lines connecting English ports with the Iberian peninsula, the West Indies and British North America.³⁷ In 1840 there followed a contract with the Peninsular & Oriental Steam Navigation Company (P & O) for a two-stage service from Britain

³⁵ Compare, for example, the beginnings of steam shipping between Batavia and Surabaya in the 1820's (*Encyclopaedia van Nederlandsch Indië* IV [1918] 'Stoomvaart', 111-112), with those of the almost simultaneously opened steam run between Venice and Trieste.

³⁶ This applied, above all, to the EIC for the Bombay-Suez run and the Dutch East Indies government which operated a steamer between Batavia and Singapore.

³⁷ Amongst the rapidly growing literature see the excellent overview in Freda Harcourt, 'British oceanic mail contracts in the age of steam, 1838-1914', *Journal of Transport History* 3rd ser., 9 (1988) 1-18 (and the references cited there); more specifically on the P & O, her 'The P & O Company: Flagships of Imperialism', in S. Palmer & G. Williams, eds. *Chartered and Uncharted Waters* (London 1982) 6-28; and on the BISN, Broeze 'Imperialism and Dependency', 441-446, and J. Forbes Munro 'The "Scrubby Scotch Screw Company": British India Steam Navigation Co.'s Coastal Services in South Asia, 1862-1870', in L. R. Fischer, ed. *From Wheel House to Counting House: Essays in Maritime Business History* (St. John's, Newfoundland 1992) 43-72.

to India via Egypt which was presently extended by a service from Bombay via Singapore to China.

Shipping, trade and passenger traffic in Asian waters was revolutionised by this development, even more so when the Bengal & Burmah Steam Navigation Company (in 1862 renamed the British India Steam Navigation Company [BISN]) from 1856 opened a network of subsidised services around the Indian coast as well as eastward and westward into Southeast Asia and the Persian Gulf. The government of the Dutch East Indies, in 1850, accepted the proposition of W. Cores de Vries and began its own rapidly growing network of subsidised lines in the archipelago. In 1867 the BISN gained the contract for an even larger network in the Dutch East Indies which, because of the local protectionist shipping registration act, it operated through a Dutch subsidiary. In 1864 the French Messageries Impériales, imitating and challenging the British, gained a contract for the French trunk route from Marseilles to Saigon via Egypt. After the opening of the Suez Canal in 1869, finally, a number of steam shipping companies emerged in the Netherlands which also enjoyed government support on their direct service to the East Indies.³⁸ These Western shipping lines, in their turn, stimulated the growth of a number of repair docks and other facilities, to which later more reference will be made.

It would, at this stage and under these circumstances, be unrealistic to assume that Asian shipowners could gain entry into the new intercontinental trades as they for a short while had enjoyed under sail. But in the intra-Asian trades enough traffic was being generated for a transition from sail to steam, as the growth of the BISN and Cores de Vries and also the growth of Western steam shipping on the Chinese coast indicated. A bird's eye view around Asia shows that Asian businessmen indeed did not hesitate to enter the field and thus transfer steam technology in shipping to their control. In due course, but outside our period, their achievement was to be challenged head-on by Western, and then also Japanese, interests whose greater resources ensured that much of this early Asian mastery over steam shipping and steam shipping technology, in very similar fashion as to what had happened in the wooden sailing-ship industry, was transitory. Around 1880, however, one could have believed that their position was secure, albeit modest, and in some areas even promising.

The first local steam shipping company in India was established at Bombay in 1845. Reflecting the still existing and perhaps even promising close relations between British and indigenous enterprise, the Bombay Steam Navigation

³⁸ Kok, *Scheepvaartbescherming*, 101-112.

Company was a joint venture of British and Indian capital.³⁹ It operated ferry and coastal services and soon provided indispensable in linking Bombay with its maritime hinterland ranging from Gujarat in the north to Kerala in the south. In 1869 the company was reorganised and the proportion of its Indian ownership further increased. Between 1898 and its takeover by British interests in 1906, the Bombay Steam Navigation Company was even fully Indian-owned. It survived so long where many other companies failed. From the late 1850's to c. 1870 almost twenty steam shipping ventures were launched in Bombay and Bengal. All failed, due to insufficient demand, faulty management and the sharp rivalry of the established British companies, above all BSN. The only other company extant in 1880 was the Bombay and Persia Steam Navigation Company recently (1877) founded by a group of Muslim businessmen for the *hajj* traffic between India and Jiddah. Clearly, then, local enterprise could exist in the niches left unoccupied by Western companies; any venture into well-established trade routes, for example between Bombay or Calcutta and China, had been quickly pushed aside.

In the Dutch East Indies, similar to the situation on India's west coast, there were still market gaps between the ever denser fabric of Western steamship services. While these, for bulk cargoes, helped local sailing-ship owners to survive, they also stimulated non-Western businessmen to venture into steam. In 1875 their vessels were still "of small tonnage and found employment exclusively in tramping or on roadsteads".⁴⁰ But in the later years of the decade and the 1880's they also ventured out into longer-distance routes. The East Indies shipping registers show that especially Chinese made their presence felt while Arabs, after a number of incidental ventures,⁴¹ fell away quickly. This pattern corresponds closely with that of Singapore and raises the question as to the causes of this ethnic differentiation which was just the reverse of the participation of each group in the European sailing-ship industry. It is suggestive to conclude that the Arabs constituted a closely-knit maritime community whose accomplishments were intimately tied to their mastery over the technology of timber, while Chinese businessmen already by that stage specifically and consciously followed the European technology. Probably more importantly, Chinese owners were able to tie in their operations with extensive Chinese commercial networks while Arabs, whose vessels had largely been freight carriers on account of others, had no such support.

³⁹ T. S. Sanjeeva Rao *A Short History of Modern Indian Shipping* (Bombay 1965) 59-67.

⁴⁰ J. N. F. M. à Campo *Koninklijke Paketvaart Maatschappij. Stoomvaart en staats-vorming in de Indonésische archipel 1888-1914* (Hilversum 1992) 53.

⁴¹ These may have included a short-lived venture in the *hajj* trade with Jiddah (*Encyclopaedie van Nederlandsch-Indië*, IV, 116).

In the British and Dutch colonies there never was any thought about using the mail subsidies to encourage local, non-Western, shipping enterprise. Paradoxically and rather perversely, classical liberal laissez-faire ideologies were used to justify the destruction of local shipowners in their rivalry with established Western companies. With regard to the relationship between Western and Chinese steam shipping in Southeast Asia, to a certain extent the same observation can be made as that made with regard to Indian shipowners: without political support indigenous shipowners were restricted to niches left open by their more powerful rivals.⁴² But especially Singapore offered many more such opportunities than India and from the 1870's a variety of Chinese entrepreneurs jostled for positions in the many short-distance routes. These linked Singapore with its complex maritime hinterland which often also included ports in the Dutch East Indies. Thus, by 1879 already eight Chinese steamship owners were registered in Singapore, including Bun Hin & Company who in the 1880's operated services to Malaya and China and had agencies at Hong Kong, Swatow, Amoy and Penang.⁴³ At Hong Kong, Kwok A Cheong played very much a similar role as the first Chinese to own steamships and by adopting Western business methods built up a commercial fortune.⁴⁴ In a number of these regional trades these overseas Chinese could flourish until the outbreak of the Great War but in due course also they came under increasing pressure and the steamship was largely 're-transferred' to Western control.⁴⁵

The diffusion of steam navigation led to a considerable diffusion of repair facilities in Asian waters as steamers could not easily be repatriated for repairs or maintenance. These enterprises, in themselves, provide useful examples to consider the question whether and how much such Western industrial and technological development gave impetus to modernization in their port cities and hinterlands. Both British front runners, the P & O and BISN, set up their own establishments at Bombay and Calcutta, respectively, and the former also in several other major ports of call, including Singapore. At Whampoa they took over the existing mud dock and put it under supervision of the Scot John Couper; the simple reason for this change was 'the coming of the iron ship'.⁴⁶ Eighteen years later, in 1863, out of this modest enterprise arose the independent Hong Kong & Whampoa Dock Company. By 1870 this company controlled all docks

⁴² J. N. F. M. à Campo *KPM* 53-54.

⁴³ Song *Chinese in Singapore* 200-1 and 209, and J. N. F. M. à Campo 'De chinese stoomvaart in de Indische Archipel', *Jambatan* 2 (1983/84) 2-12.

⁴⁴ Austin Coates *Whampoa: Ships on the Shore* (Hong Kong 1980) 87.

⁴⁵ K. G. Tregonning *Home Port Singapore: A History of Straits Steamships Company Limited 1895-1965* (Singapore 1967) Ch. 1.

⁴⁶ Coates *Whampoa* 12.

and repair facilities at Hong Kong.⁴⁷ During the 1870's Hong Kong & Whampoa began the construction of river boats, lighters and launches; later sea-going steamers were added to its program.⁴⁸ Between 1875 and 1897 the Chinese work force of the yard fluctuated between 4,700 and 7,000 men which made it one of the largest, if not the largest, such expatriate enterprise. Indeed, the enterprise was a remarkable example of industrialisation in Asia but its management and engineering leadership remained firmly in British hands. It is difficult to discern any technological influence of the yard on China and the same applies to Swire & Butterfield's yard of river craft in Shanghai. Rather than being a pioneering bridgehead, Hong Kong & Whampoa despite its large work force remained a Western island in which there was a clear racial hierarchy—and separation—of labour, technology and, above all, power. Very much the same judgement must apply to the Tanjong Pagar Dock Company at Singapore (1879 some 2,500 employees),⁴⁹ and smaller establishments such as Walker & Son at Colombo or those of Cores de Vries and later the NISM at Batavia.⁵⁰

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The situation and structure of merchant shipping under colonial control stood in stark contrast with the situation in China proper and Japan after their enforced 'opening' by the West in mid-century.⁵¹ There, government could and did intervene in the development of industrial and transport technology. Often such intervention was inspired by political motives and partly if not wholly directed toward the building up of military and naval resources. Considerable differences existed between the political and economic situations of China and Japan and, in consequence, also in their maritime policies and achievements. But, naturally, both were aimed at gaining a foothold in coastal and regional trade routes through the building up of strong liner companies. Besides resulting in

⁴⁷ *Ibid.*, pt. 3.

⁴⁸ *Ibid.*, pt. 7.

⁴⁹ C. M. Turnbull *A History of Singapore 1819-1975* (Singapore 1985) 95. The P & O establishment was later amalgamated with Tanjong Pagar.

⁵⁰ J. N. F. M. à Campo *KPM* 422.

⁵¹ And, in principle also Persia and the various independent shaykhdoms around the Arabian peninsula. In the Red Sea the 'sub-imperial' Egyptian-controlled Khedivial Mail company (1873, ex-Aziziyah Misriyah of 1870) prevented any Arab shipping ventures. Charles Issawi (*The Economic History of Iran 1800-1914* [Chicago 1968] Ch. 4) makes no mention of any Persian ventures into steam shipping; reflecting the general pattern of semi-imperialist domination in Iran the Caspian sea trade was entirely controlled by Russian companies, while the Gulf and river trades were dominated by the British.

obvious economic spin-offs such policies could also have a significant influence on the political posture of the countries involved.⁵²

China, of course, was divided in three parts: the areas under total Western control such as Hong Kong; the semi-colonial treaty ports and cities such as Shanghai with its internationalised river system; and, finally, 'China proper' where Chinese authorities exercised full control. Coastal Chinese waters and, from 1862, the rivers had been the theatre of a lively competition between a number of British and American companies.⁵³ In these relatively cramped conditions rivalry led to agreements which were forerunners of the worldwide conference system and, inevitably, were detrimental to Chinese requirements. Although individual Chinese merchants had previously invested in Western companies (which gave them privileged access but no control), in 1872 the energetic and visionary Li Hongzhang, Governor-General of Zhili and Commissioner for the Northern Ports, founded the first modern Chinese steam shipping company. Aiming at attracting mercantile capital through state sponsorship,⁵⁴ the Chinese Merchants Steam Navigation Company (CMSNC) began operations with a small fleet including three new-buildings from Britain. Success came to the new company after Li appointed Dong Jing-sing, until then Jardine Matheson & Company's comprador, as manager.⁵⁵ As Dick and Kentwell have expressed it succinctly, Dong "combined a very good knowledge of Western business practice and the technical side of ship management with excellent contacts in the business community".⁵⁶

By 1876 the CMSNC was established enough to become a major player on the rivers and, from 1879, also the coast. Moreover, Dong bought the Shanghai Steam Navigation Company from the ailing American firm Russell & Company and for a time his situation looked to be very favourable.⁵⁷ Some partners of Jardine, Matheson & Company were willing to sell their shipping interests to the

⁵² Cf. à Campo, *KPM* part 1 ('Macht'), and J. Forbes Munro's nascent biography of Mackinnon and his BISN for similar arguments about state formation in the colonial context.

⁵³ Liu Kwang-ching *Anglo-American Steamship Rivalry in China, 1862-1874* (Cambridge, Mass. 1962).

⁵⁴ I. C. Y. Hsu *The Rise of Modern China* (New York 1970) 340 and 344-346.

⁵⁵ On Dong see Liu Kwang-ching 'A Chinese Entrepreneur', in M. Keswick, ed. *The Thistle and the Jade* (Hong Kong 1982) 108-117.

⁵⁶ H. W. Dick & S. A. Kentwell *Beancaker to Boxboat: Steamship Companies in Chinese Waters* (Canberra 1988) 178-9.

⁵⁷ Many Westerners in China actually believed that the purchase of the Shanghai SNC, with the takeover of the Woosung railway, indicated a new phase in the policy of the Chinese government aiming at the total expulsion of all Westerners and the nationalisation of their property (S. Marriner & F. E. Hyde *The Senior John Samuel Swire 1825-98: Management in Far Eastern Shipping Trades* [Liverpool 1967] 66).

CMSNC.⁵⁸ But the CMSNC was heavily burdened by loans and debts and only a moratorium on payments made possible by Li allowed Dong, by 1882, to reach agreements with the strong British companies, Jardines and Swires. During the struggles of these years he also, coincidental with a number of Japanese projects,⁵⁹ experimented with sending ships outside East Asian waters. Although the latter ventures, made in years of financial difficulty, remained exceptional and made no inroads into the Western dominance of long-distance trade routes, they deserve to be recalled: several voyages during 1879-81 to Hawaii and San Francisco and one in 1881 to London. More permanent were the lines opened, from 1880, to Indochina and Southeast Asia.

Although the CMSNC became a company of considerable size, it was started later and made less impact in terms of the transfer of technology than the naval effort on which China's self-strengtheners after the disastrous First Opium War had embarked. Their effort found its first culmination in Li Hongzhang's Jiangnan arsenal in Shanghai, which included an ironworks and in 1865 added shipbuilding to its activities.⁶⁰ Until 1875 the plant had produced not only nine steamers, including the 3,000-ton *Hai An*, but also most of their boilers, pumps and engines. Chinese workers constructed ordnance and torpedoes at Tianjin. From our viewpoint perhaps most importantly, a full-scale dockyard was built at Fuzhou under a contract (1866) with the French engineer Giquel. The yard also included a naval academy with a design department concentrating on engine design. Local construction of steam engines commenced in 1869 and by the end of the contract, in 1874, fifteen ships, mainly of small tonnage, had been built. Interestingly, four of these were launched as passenger and freight carriers for the CMSNC.⁶¹ The outbreak of the Liuqiu [Ryukyu] crisis (from the Japanese perspective known as the Formosa Incident), however, saw them appropriated by naval authorities before they could enter commercial service. In sharp contrast to developments in Japan, the crisis had no direct positive effect on the development of the CMSNC or any rival shipping enterprise. No policy of subsidies was adopted; on the contrary, the company was later even required to contribute to the 'naval fund' of 1889.⁶² The political base, from which modernisation was attempted in China, evidently remained fragile and incapable of formulating and sustaining a clear merchant shipping and shipbuilding policy. No doubt, however,

⁵⁸ Keswick *The Thistle and the Jade* 116.

⁵⁹ William D. Wray *Mitsubishi and the N.Y.K., 1870-1914: Business Strategy in the Japanese Shipping Industry* (Cambridge, Mass. 1984) 264.

⁶⁰ John L. Rawlinson *China's Struggle for Naval Development 1839-1895* (Cambridge, Mass. 1967) 41.

⁶¹ *Ibid.*, 51.

⁶² *Ibid.*, 142.

could exist about the social base of China's maritime expansion: despite their obvious educational handicaps the Chinese possessed all the qualities and aptitudes required for success.

Nevertheless, although they were outdated with their wooden hulls and paddles, the Fuzhou ships gave China a technological base which could have given further impulses.⁶³ But in the tumult of the times the self-strengtheners came up against strong conservative forces and, moreover, were divided between those who wanted to build their navy at home and aim for the long term and those who saw the need for the immediate importation of larger and more modern craft from overseas. While some small craft continued to be built at Fuzhou until the disastrous war with France,⁶⁴ the latter policy prevailed (and, ultimately, failed against the power of the Japanese navy). In due course, as happened in several other countries,⁶⁵ China might have used those imports as prototypes for indigenous naval construction programs and a massive navy-led transfer of technology from which merchant shipping would undoubtedly also have benefited. At the time, however, even if the flow of information from the West was not cut, the momentum of indigenous modern shipbuilding was fatally broken. Another outcome of this policy reversal was that the growth and development of the CMSNC could neither exert a stimulating influence on China's shipbuilding industry nor derive strength from it. The company had to continue to rely on importing vessels from Britain.⁶⁶

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It is historical orthodoxy to contrast the failure of China to successfully adopt modern military and naval technology for defence against the predatory actions of the various imperialist powers with the rapid modernisation of Japan with her ideology of *bummei kaika* (civilisation and enlightenment).⁶⁷ This ideology, in turn, is contrasted with the predominantly conservative outlook of China's leaders and, more or less tenuously, is linked to the *Rangaku*, the Dutch studies which were maintained during the period of exclusion in Japan. It is

⁶³ It might be added, too, that the choice of French engineers was unfortunate, as British shipbuilding and technology and marine engineering was clearly superior.

⁶⁴ For a brief overview of the Fuzhou dockyard and naval academy and their destruction, in 1884, by the French, see Bruce Swanson *Eighth Voyage of the Dragon* (Annapolis 1982) 76-80.

⁶⁵ See, e.g., Russia, Spain, and Japan itself. For a discussion of these issues see Clive Trebilcock 'British Armaments and European Industrialisation, 1890-1914', *Economic History Review* 2nd ser., 26 (1973) 254-272.

⁶⁶ Dick & Kentwell, *Beancaker to Boxboat* 193-9.

⁶⁷ On the broad setting of Japan's modernisation see the thoughtful book by Jean-Pierre Lehmann *The Roots of Modern Japan* (London 1988).

arguable, however, to what extent China's fate was already sealed in 1880, even if the weaknesses in China's political and socio-economical structure and outlook were clearly visible. At the same time the basis of modern Japan had well and truly been laid. A significant number of overseas missions⁶⁸ had demonstrated the utter determination of the reformers but, as the preceding passages have shown, China was making a great effort in both its maritime spheres. Yet the Formosa Incident had confirmed Japan's control over the Ryukyu Islands and, even if by 1880 China's naval program was getting under way, Japan was already ahead. As early as 1855 the Netherlands had donated a naval paddle steamer (the *Kanko Maru*) to Japan and in 1858 the first repair facility existed for such steamers.⁶⁹ The modern Imperial Navy originated between 1868 and 1871 when it was brought into a separate ministry. The Yokosuka dockyard served as a fulcrum of technological modernisation and, although a policy of buying abroad was largely maintained, modern steam technology was rapidly being absorbed.⁷⁰ A Naval Engineering School existed since 1876 and soon two more shipyards were opened at Nagasaki and Hyôgo (Kôbe). By 1883 the latter two had built over thirty steamers, several of which merchantmen that could also serve as auxiliary warships.⁷¹

Japan's maritime advances must also be seen against a general sense of the importance of the navy as a vital instrument for both self-defence and regional expansion. The Formosa Incident, in particular, had shown the crucial importance of a modern merchant fleet along Western lines. Although Japan's fleet at the time also contained square-riggers,⁷² government policy was focused on steamships. In 1880 there was 41,215 tons of sailing-ship tonnage on Japan's register but already at that early stage sail had been overtaken by steam.⁷³ Steamer tonnage in

⁶⁸ According to W. G. Beasley (*The Rise of Modern Japan* [London 1990] 85) between 1862 and 1867 no less than 68 missions left Japan for overseas and this movement continued unabated after 1870. Later missions included both large civilian complements, such as the Iwakura Mission, and individual military-naval ones, like that of Heihachiro Togo.

⁶⁹ J. Stellingwerff *Zijne Majesteits Raderstoomschip Soembing overgedragen aan Japan* (Zutphen 1988); H. Stapelkamp 'Hendrik Hardes (1815-1871): grondlegger moderne Japanse scheepsbouw en industrie', *Tijdschrift voor Zeegeschiedenis* 11 (1992) 33.

⁷⁰ W. M. McGovern *Modern Japan: Its Political, Military, and Industrial Organization* (London 1920) 178-180.

⁷¹ John K. Fairbank, Edwin O. Reischauer & Albert M. Craig *East Asia: The Modern Transformation* (London 1965) 246; [N.Y.K.] *Golden Jubilee History of Nippon Yusen Kaisha 1885-1935* (Tokyo 1935) 9.

⁷² Jansen *Sakamoto Ryoma* 183. Many of the sailing ships were bought by owners of *wasen* who desired to 'upgrade' their participation in the inner-sea and domestic trade routes: K. Nakagawa 'Japanese Shipping in the Nineteenth and Twentieth Centuries: Strategy and Organization', in T. Yui & K. Nakagawa, eds. *Business History of Shipping* (Tokyo 1985) 5-6.

⁷³ A. W. Kirkaldy *British Shipping: Its History, Organisation and Importance* (London 1919) Appendix XVII. Japanese sailing ship tonnage actually peaked in 1910 at 412,859 tons, but

1877 totalled 79,202 tons, and eight years later 88,765 tons.⁷⁴ As in the case of the CMSNC Japan's modern shipping sector was 'held up' in the difficult years around 1880, but its dynamism was amply illustrated by the symbiosis between government and business in the form of the financial support given after the Formosa Incident to the Mitsubishi company.⁷⁵ This fertile business-government relationship was strongly reminiscent of the vital alliance between the government and long-distance steam shipping companies in Britain which has been signalled earlier and which was of such crucial importance in promoting British steam shipping, construction and technology ahead of their foreign rivals. After buying the Pacific Mail Steamship Company's Yokohama-Shanghai line and successfully fighting off the P & O on the same route, Mitsubishi with its incipient network of overseas services, in 1880, was poised for further expansion. But by contrast with the virtual monopoly position of the CMSNC in China, elsewhere in Japan entrepreneurial forces were building up which soon challenged Mitsubishi and the immodest advantages it gained under the subsidy system.⁷⁶ After a dramatic shift in political power the Japanese government itself even supported the rise of Mitsui as a rival company, but from our viewpoint more important is that the shipping industry as a whole was highly dynamic.⁷⁷ As such it constituted an extremely powerful element in the growth of Japan's overseas trade and the country's regional expansion which was confirmed in the formation (1885) of Nippon Yusen Kaisha. Elsewhere this concentration of forces on Tokyo had been anticipated by the foundation of the Osaka Shōsen Kaisha.

Shipping was of vital importance to Japan. The country's configuration, rapid economic growth, political and strategic posture reinforced each other synergically in pressing for the adoption of modern steam tonnage. Geo-political armchair theorists were soon to make suggestive comparisons between Britain and Japan as 'windswept isles' off the opposite ends of Eurasia. In the absence of a fully-fledged metallurgical industry, however, for a considerable time the actual building of modern merchant vessels was not promoted as a matter of national

against that figure stood no less than 1,233,785 tons of steamships. The figures for China for 1910 were: 14,314 tons sail and 88,888 tons steam shipping!

⁷⁴ Wray *Mitsubishi* 98 (Table 6) and 279 (Table 41).

⁷⁵ *Ibid.*, Chs. 1-3.

⁷⁶ *Ibid.*, Chs. 4-5; R. Miwa 'Maritime Policy in Japan: 1868-1937', in Yui & Nakagawa *Business History* 126-130; *The First Century of Mitsui O. S. K. Lines, Ltd* (Osaka 1985) Ch. 1, and especially also J. Hirschmeier 'Shibusawa Eiichi: Industrial Pioneer', in W. W. Lockwood, ed. *The State and Economic Enterprise in Japan* (Princeton 1965) 233-235.

⁷⁷ This is not the place to investigate the social and/or psychological origins of Japanese entrepreneurship in shipping and the economy in general, but see K. Yamamura *A Study of Samurai Income and Entrepreneurship* (Cambridge, Mass. 1974) esp. 143-153 and 'Conclusion'.

priority. As late as 1894, only a couple of steamships of over 1,000 tons had been built in Japan itself. The only commercial repair yard of significance was that of Mitsubishi at Nagasaki; merchant steamers often had had to make use of one of the three naval establishments.⁷⁸ It was only as late as 1896, in the wake of the war with China, that the Shipbuilding Encouragement Law was passed in order to create a local industry and the marine engineering industry to back it up.⁷⁹

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The fact that Japan did not introduce its promotional legislation until 1896 demonstrates how slowly steamship building and marine engineering had penetrated into the economic fabric of Asia. After a modest start even naval construction had been largely abandoned in China and Japan for direct imports from Western sources. Although it is true that sufficient engineers and skilled manpower were being trained to service and repair these imports without Western assistance, this constituted far from a full-scale transfer of technology. Indeed, taking a bird's eye view of the Asian littoral c. 1880, the picture is one of as yet very limited transfer. There were the naval dockyards of the independent powers as well as those maintained by Britain, France and the Netherlands in their colonies and then, in the commercial sphere, the maintenance establishments of the P & O and BISN in Calcutta and the several repair yards in other nodal points of the modern steamship network in ports such as Hong Kong, Singapore, Batavia and Colombo. Technologically, these were Western implants rather than fulcrums of change in their Asian environment.

The total absence of a modern Asian shipbuilding industry was all the more striking in view of the large production, in the beginning of our period, of high-quality wooden sailing ships in a large number of Asian shipyards. Technological change as well as political interference on the part of metropolitan governments, however, had made the transition from wood to metal and from sail to steam a total impossibility and as all regional mail contracts were given to metropolitan steamship companies also these had not been able to provide stimulus for a local industry. To a certain extent, however, there may have been a clear choice on the part of Asian businessmen not to invest in metal shipbuilding. The spectacular rise of the Bombay textile industry in the 1860's and 1870's, for example, demonstrated the large funds available for industrial investment which at least partly could have been used for marine construction. It seems, however, highly unlikely that such a shipyard would have been profitable in the absence of

⁷⁸ *Golden Jubilee* 37.

⁷⁹ T. Nakamura *Economic Growth in Prewar Japan* (New Haven-London 1983) 60.

strong local demand. Very much the same conclusion can be drawn about China, where the 1870's witnessed the first steam silk filatures,⁸⁰ and Japan where higher priorities were assigned to the available public and private capital and local shipowners continued to rely on imports. As also Singapore demonstrated, it was not so much any restraints imposed by shortages of entrepreneurial dynamism, skilled labour or other such input factors but rather the universality of the markets for both new and second-hand vessels which enabled Asian owners, not unlike many new and geographically marginal entrants in Europe (such as Finland, Norway or Greece) to meet their requirements. Thus they had no incentive to press for the development of a local shipbuilding industry.

In comparison, Asian Western-style merchant shipping fared considerably better than shipbuilding, although its overall record was modest and patchy. Asian shipowners, particularly in India and Southeast Asia but later also Japan, bought both Asian and second-hand Western sailing ships in large numbers. Although *de facto* excluded from the intercontinental trades with Europe and the United States they found ample employment in the Asian seas, sometimes supplementing, sometimes competing with European-owned tonnage. Arabs, Indians, and overseas Chinese became major participants, but only the latter two groups made the transition to steam. Commonly small operators, they were from the early 1870's joined by the much larger 'home' Chinese and Japanese companies, above all the CMSNC and Mitsubishi. With strong government support these companies had the potential to become real players in their regions and perhaps beyond; from the vantage point of 1880, however, it was not at all clear what the next fifteen years or so might bring. Yet the position of the CMSNC and Mitsubishi was potentially much stronger than that of Asian owners in the British and Dutch colonies. Essentially, it is difficult to see in what directions such smaller owners could have expanded without provoking reactions from established Western companies. It is unlikely that lack of investment funds constituted a strong negative factor. Although the Westerners could command far more financial power, in specific sectors and for specific purposes Asian owners, with or without government subventions, were able to find enough support through family, business and other connections. But, ultimately, business and government leaders often had other concerns and priorities than merchant shipping.

⁸⁰ Robert Y. Eng 'Chinese Entrepreneurs, the Government and the Foreign Sector: The Canton and Shanghai Silk-Reeling Enterprises, 1861-1932', *Modern Asian Studies* 18 (1984) 353-356.

What, finally does all of this mean for our theme of the transfer of technology and science in maritime transport?⁸¹ By 1880 in China and Japan steamers were being built which, in comparison with Western shipbuilding and marine engineering standards, could only be seen as modest steps on the path towards complete transfer. The training of engineers had been taken up in the navies of both countries and an active flow of information from Europe complemented the significant number of professional missions and overseas training courses. But at the same time the adoption of 'buy abroad' policies without commitment to using those foreign-built vessels as models for a home construction program delayed effective full-scale transfers such as Japan was to achieve after the turn of the century. Very much the same conclusion applies to China's naval and commercial sector and Japan's merchant shipbuilding and engineering. At this stage of developments it is not surprising that academic studies in these subjects also were not yet part of any university curriculum. As yet no home-grown scientific base existed for this industry. In short, China and Japan had made partial transfers, the latter more so than the former.

By contrast to politically independent China and Japan, the situation elsewhere was far from advanced. The string of naval and commercial repair shops in colonial dependencies was fully controlled by Westerners. Local inhabitants provided the labour and perhaps part of the clerical staff. Western technology was handled by these yards but this cannot meaningfully be identified as an effective form of technology transfer. Despite their large size they had virtually no impact on the modernisation of their hinterland or the technological education of their indigenous work forces. There were no training courses for indigenous aspirants nor educational voyages to Europe.⁸² No technical works or any other specialist publications were imported other than for the European management. The yards formed part of the Western sector of these largely dualist economies. While shipping to a certain extent stood open to Asian participation, no such breakthrough had been made in ship construction and repair. The technology of transfer is an extremely complex process involving many other and complex issues, but in the maritime industries the comparison of the achievements of China and Japan with the fortunes of the Dutch and British colonies shows that evidently no effective transfer and no access to the sources of Western technology could be achieved, or even initiated, without political power.

⁸¹ There is a vast literature on the transfer of technology in general, but regrettably shipping and shipbuilding are virtually completely neglected in these texts. See, e.g., D. J. Jeremy, *International Technology Transfer: Europe, Japan, and the U.S.A., 1700-1914* (Aldershot 1991); I. Inkster *Science and Technology in History* (London 1991) esp. 20-25.

⁸² The only exception in this context was the practice of the (largely Indian-owned) Bombay SNC to employ local engineers on its fleet.