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SHIP- CONSTRUCTION IN MUGHAL INDIA

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Development of modes of transport is one of the important factors which are essential for the development of not only economic, social and military, but also for the overall prosperity of any country. The Mughal Empire from the very first day of their direct contact to the Indian Ocean just after the conquest of Gujarat in 1572 A.D., developed interest in the ocean. Akbar travelled in a *taory*, a barge which also used to ply between India and Red sea.[1] And in a very short period Akbar sent, however, hesitantly his family members in two vessels built or acquired by him namely *Salimi* and *Ilahi* for the hajj pilgrimage.[2] Later on Akbar built two ships at Lahore in 1593 and 1596.[3] This interest continued under other Mughal emperors also especially Jahangir, Shah Jahan and Aurangzeb. It was Jahangir during whose period Europeans established themselves in Surat by receiving royal *firmans*. He himself used to invest in the ships voyaging to Mecca. Shah Jahan, as Prince Khurram, took great interest in shipping, when he became governor of Gujarat, and he built and plied his own ships. The two famous ships owned by him were *Shahi* and *Ganjawar*. His interest continued after becoming Emperor also. Aurangzeb also took great interest in shipping especially in sending ships to Mecca. The *Ganj-i Sawai* was his ship whose seizure by the English is a well-known incident.[4] Other royal family members also used to invest in shipping such as Princess Jahan Ara and Prince Dara Shukoh etc. Nobles were also involved in shipbuilding and shipping.[5]

In Mughal India, taking into consideration the waters and places where the vessels were used we can broadly divide them into three classes; the first vessels used only in the ocean such as junka and other ships (*jahaz)*, etc. second vessels used both on the ocean and along the coast but mostly on the coast such as *ghurab*, *taory*, *sambuk*, *shibar*, *manchua*, *balloon*, and other kinds of boats, and the third vessels used for internal navigation i.e in the rivers such as *parao*, *purgo*, *catamaran*, *patella*, *jelia* etc.[6]

It is true that Chinese junks were withdrawn from the Indian Ocean in middle of the fifteenth century, but Indians continued to copy the construction of Chinese type vessels.[7] However the Indian junks were different in some particulars from their Chinese prototype.[8] We have a very good description of the Indian junk from Peter Mundy at Surat.

He tells us 'Juncks are theis Country vessels, soe called by us, of which many belong to this place, among the rest some of 1000 or 1200 Tunn each, and but one Deck. Theis put to Sea with Easterly Monsoon, and before the wynde out goe our shipps, by reason of purpose, as being confident of the continuance of faire and moderate winds and weather during that Monsoon.'[9] These junks had particular kind of movement as noted in 1663 by English factors where they warned against using a 'jounk for that ....doe by a wind too much resemble in their motion the nature of crabbs, who looke one way and creep a contrary'.[10] Abul Fazl himself used the word *qafila-i junk* for the convoy of the vessels acquired by Akbar, for sending his family ladies for hajj in 1576.[11] Of the two ships, built by Akbar him at Lahore, the first one had length of its keel 35 *gaz-i ilahi*, a little over 93 feet and second one, a length 37 *gaz*, or nearly 99 feet, but whether at keel or at upper deck is not stated. One supposes that their design was based on the plan of the India junks.[12] Again, it is inferred from a rare manuscript of Mughal period preserved in Bibliotheque Nationale Paris (Blochet. Supp. Pers. 482) and translated by Shireen Moosvi, that two famous ships of Shah Jahan , *Shahi* and *Ganjawar* were almost certainly junks.[13] In the English factory records Indian big vessels are usually designated junks. The ships captured by the English off the Aden and Red Sea ports early in Jahangir.s reign were described by them as junk and they provided us with the measurements of some of the junks. The biggest among the captured junk, the *Rahimi* was of 1500 tons burthen, according to John Saris, ' [It] was long from stem to sterne-post, an hundred three and fiftie foot. For rake from the Post afte, seventeene foot. From the top of her sides in breadth, two and fortie. Her depth, one and thirtie'. Again they measured the '*Mahomedee*' which was 'in length, an hundred sixe and thirtie foot. Her rake afte, twentie. In breadth, one and fortie. In depth, nine and twentie and half. Her maine Mast in length, was sixe and thirtie yards, an hundred and eight. Her maine yard, four and fortie yards, an hundred two and thirtie'. Further they found that the other junks were not much smaller.[14] Junks were also built by the Portuguese for the Indians; however it is not clear whether they built these by their own methods or in the Chinese style especially for the Indians.[15] Some Indian techniques like 'rabiting' were not followed, so that a ship built by the Portuguese at Chaul 'being (as the *Supply*) in the major part Calked work and not rabited, which building is only known to these people' was rejected by the Governor of Surat and the servants of Prince Dara Shukoh. At the same time a ship built at Daman under the Portuguese aegis was not rejected by them which also confirms that the Portuguese did build ships for Indians keeping in mind the Indian method.[16] Later on the term junk was used for any

big vessel in the Indian waters.[17]

In Mughal India, planks of vessels were joined mostly by a method called 'rabeting', a tongue and groove method. However other methods were also applied by them.[18] Wheras 'rabeting' was also done by the Europeans, they mostly relied on the method called 'caulking'.[19] In 1668 the English factors advocating the building of ships in India wrote to the Company that '.....the carpenters wrought their work very cheape, substantial, and strong, of planke let into each other, with cotton tarr, and then spiked, which is called riveting worke, this is, to our knowledge, very lasting, and admitts no cauklking or other trimming then chynaming once a year, which is done in one springe [tide], and this execuseth all caulking worke, ocum, pitch, and tarr, with the expence of many carpenter and caulkers;...'.[20]

Earlier, Indians used to join the planks by stitching or sewing with rope. It is only at the beginning of the sixteenth century that sources begin to note the presence of iron fastenings in Indian ships, as is shown by the accounts of Pedro Alvares Cabral, who tells us that on the south west coast that 'the ships are made with iron nails'.[21] Ludovico di Varthema, in the first decade of sixteenth century found at Calicut that 'they put in an immense quantity of iron nails' in building their ships.[22] Gaspar Correa, writing the history of the first voyage of Vasco da Gama, noted that most vessels present at Cananor were sewn, but there were iron-nailed vessels also which were flat-bottomed.[23] If we believe Gasper Correa, who mentioned the presence of nailed vessels at Andijiva and Cananor, at the coming of Vasco da Gama, it cannot be denied the use of iron in Indian vessels, was still not employed on a large scale. In Mughal times, on the contrary, we have ample evidence that there was no dearth of iron in India, especially on the Coromandel Coast.[24] In Mughal India, in late sixteenth century, we have very interesting and informative description of use of iron nails in joining planks, in the *Akbarnama* of Abul Fazl. An immense quantity of iron nails was used in the building of two ships at Lahore by Akbar in 1594 and 1596.[25] From the paintings of Mughal period it is also confirmed that they used iron in building their ships.[26] And this is an important proof against the popular notion that, Indian ships were only stitched and sewn with rope and there was no use of iron. The use of iron was already prevalent in the China even before the coming of Portuguese, which undermines the supposition that this shift towards the use of iron was due to European influence.[27] It may be possible as A.J. Qaisar has suggested that the shift towards use of iron was a necessity to cope with the strong and war-like ships of the Portuguese.[28]

It is true that, most of the Indian vessels, before the Mughal period had no decks, as observed by the travellers in that period. Stefano in 1490, during his return journey from Sumatra to Cambay, met with an accident, 'so that the vessel, having no deck, became filled with water to such a degree, that there was no means of bailing it out, and it sunk, and those who could swim were saved and the rest were drowned.'[29] Earlier Marco Polo (c.1290) and later Barbosa in 1516 had found the Indian vessels without decks.[30] But at the same time we have a description from Nicolo Conti (1419-44), who, found Indian, vessels with decks and compartments.[31] In our period the vessels were built with decks. During his return journey from Mecca in 1582, Bayazid had to retire due to the mutiny of Gujarati *khallasis*, who were sympathetic to Muzaffar, the former ruler of Gujarat, into special cabin (*dabosa*). According to Tek Chand Bahar, 1739-40, a *dabosa* was cabin in ship or boat which was below the elevated part of deck.[32] And it was the characteristic of the junk-type vessels to have a deck.[33] Most striking description of decks and cabin comes from Hamilton, who found these features even in a boat (*kishti*) on the Indus. He observed that, 'Their Vessels are called *Kisties*, of several Sizes. The largest can lade about 200 Tuns. They are flat-bottomed, and, on each Side, Cabbins are built from Stern to Stem, that overhang about 2 Foot; and, in each Cabbi, is a Kitchen and a Place for Exoneration, which falls directly in the Water. Those Cabbins are hired out to Passenger, and the Hold, being, made into separate Apartment, are let out to Freighters, so that every one has a Lock on his own and has his Goods always ready to dispose on at what Place he finds his Market. And indeed in all my Travels I never saw better Conveniencies of travelling by water...'.[34]

In Mughal India, according to Abul Fazl, (c.1595) generally all over the empire ships and boats were built. He noted that on the sea-coast, in the east, west, and south, large ships were built, which 'have became a source of comfort to the seafarers, the ports have obtained prosperity, and knowledge has grown'.[35] There were certain places which were particularly renowned for the shipbuilding. There were certain factors which helped the pursuit of shipbuilding industry; supply of timber was one of them. On the western coast Surat was one of the major centres of shipbuilding, such work being also carried out at Swally.[36] About the skill of Surat carpenters, Ovington in 1689 noted that '.....And the very ship-carpenters at Suratt will take the model of any English Vessel, in all the Curiosity of its Building, and the most artificial Instances of Workmanship about it, whether they are proper for the Convenience of the Burthen, or of quick Sailing, as exactly as if they had been the first Contrivers. The Wood with which they build their ships would be very proper for our Men of War in Europe; for it

has this Excellence, that it never splinters by the Force of Bullet, nor is injur'd by those violent Impressions, beyond the just bore of the shot'.[37] Earlier in 1668, advocating the building of ships in India, the English factors noted: 'And if any shall object they may not have that shape, or be soe profitable for stowage of goods, as our English shipps are, we answere that these carpenters are growne soe expert and masters of their art that here are many Indian vessails that in shape exceed those that come, either out of England or Holland'.[38] We have uncountable evidence for the shipbuilding at Surat.[39] Abdur Rahim Khan-i Khanan, a great noble who was governor of Gujarat under Akbar (1584-5, 1586-88) and held Surat in his *jagir*, built and owned three ships the *Rahimi*, *Karimi*, and *Salari*.[40] The ship on which Bayazid and other persons went to the Red Sea '*Muhammadi*', was jointly built and owned by Qutbuddin Khan, a foster brother of Akbar who was posted as commandant of Baroch after the conquest of Gujarat, and Qulich Khan, who was the first Mughal governor of Surat after its conquest by Akbar.[41] Another noble of Akbar, Sadiq Muhammad Khan, Khan-i Jahan, who held Surat and Baroch in *jagir* in 1593, built besides other ships, the *Sadiqi* and *Akbarshahi*.[42] Surat obtained timbers easily from its surroundings. In 1618-19, for the building of Prince Khurram's Junk *Shahi*, timber was procured from the *pargana* of Telari in the *sarkar* of Surat.[43] Gandavi which itself was a good port and known for shipbuilding, and Balsar were known for their timber, which were considered best and cheapest.[44] Navsari was also famous for its timber, and that were supplied in boats to Surat.[45] It was also a shipbuilding centre and the Dutch claimed to be the first European purchasers of the Indian built ship from here.[46] Shipbuilding at Baroch depended on the timbers from other places which were brought in boats.[47] During the reign of Shah Jahan, Ali Akbar Isfahani, merchant from Persia, whose father had migrated from there, built a ship at Khambayat.[48]

Under the Portuguese, ships and boats were built at several places, such as at Diu, Goa, Daman, Bassien etc. but their main shipbuilding centres were Daman and Bassein.[49] The English factors after their peace with Portuguese, used to purchase from these places. In December, 1639, a ship of 300 tons was purchased and was named the *Supply*.[50] In 1640, a Portuguese galliot of 140 tons burden was purchased and it was renamed *Hope*.[51] In 1646, a ship of 250 tons built at Chaul and rejected by Prince Dara Shukoh, was purchased by the English and after some modification it was turned into a good ship and was named as *Expedition*.[52]

Later on areas adjoining Bombay, became the main centre of shipbuilding, after the coming of English there.[53] Initially they wanted

to bring timbers from Gandevi and Bulsar, where in their judgement timbers were the best and cheapest; however, they found the conveyance of timbers overland very expensive due to fear of payment of excessive customs to the Portuguese.[54] Later on, timbers were brought from Bassein and they found 'good tymber as the world afforded, and especially near Bombay, to be had cheaper then in any other places;..'.[55] Timber was also brought from Karwar and Baliapatam, though the timber from Karwar though very good was very dear.[56] But Surat remained the important source of timber for Bombay as in 1672, the Captain of Bassein prohibited the supply of timber and at the same time the English could not obtain it from the Malabar Coast, so they brought it from Surat. The duty charged on the timber from Bassein was 33% in addition to 20% required for a permit from the Captain of Bassein for its transport.[57] At the same time, they had to pay 33% custom to the Portuguese for the timbers for shipping and houses, which they called the 'oak of India', which grew at Kalyan and Bimurly, and passed necessarily by Tanna.[58] Timbers were also brought from Shivaji's territories.[59] Ships were also built at Kalyan Bhiwandi.[60]

In the Bay of Bengal, boatbuilding was carried out on large scale in comparison to shipbuilding, due to the reason that in the bay for port to port trade and collection of merchandise small vessels were needed as large vessels were not able to reach near the shore. In 1634, the English factors at Balasore noted that there was no thought of trade in the Bay without small vessels, as the great ships ride afar from the shore and it was the small vessel which used to bring provisions for the great ships. Therefore they thought to buy or build smaller vessels there. They purchased a 'not half finished' pinnace of 100 tons burthen from the Governor of Balasore and finished it. Another small frigate was likewise bought in Bengal about the same time (named the *Marigold*) of some 30 tunns (cost rupees 900).[61] Earlier, in 1633, when Burton, with other English colleagues, went Balasore, they found that it was a great sea town, where many ships and other vessels were being built. They further got licence 'to build shipping, small or great, or any other vessels they think best and fittest for their occasions and uses'.[62] Durson in partnership with a Moor of Balasore, had built a vessel of 200 tons, in which he intended to trade from port to port.[63] In 1661, a ship was built by English factors in the Bay and was named *Methew* and *Thomas*.[64] Europeans, especially Dutch and English were employed in constructing small vessels for the Mughal authorities. The Dutch built a galliot for the Nawab (Governor), at Hugli, which was sent to Decca.[65] Under the supervision of an English Mr. Pits a galliot was built at Decca.[66] In 1663, Thomas Pratt an Englishman was employed

by Nawab Mir Jumla for building boats.[67] In 1664, Pratt with four other persons went to Rajmahal to offer the new Nawab their service in building ships and cannons. [68] In 1664, English factor, Black had built three boats to carry goods between Balasore and Hugli.[69] In 1669, the English noted regarding building of small vessels at Narsapur instead of at Hugli, that 'wee are informed that vessels are better built in the Bay, and at easier rates for materials and workmen, then in these parts'.[70] However, vessels of large size from 4, 5, or 600 'tons' were also built in the Bay.[71] The Bay was naturally filled with timbers especially the *sarkar* of Bazuha which had timbers especially for mast and boats.[72] Sagar Island afforded great store of large Timber to building ships.[73] The Ganjam territory also had timbers for building.[74] Abul Fazl records iron mines in the *Sarkar* of Bazuha, which bordered the Khasia Hills.[75] Iron was also found in the Nilgiri Hills, and between Bhadrakh and Balasore and near Ganjam.[76]

On the Coromandel Coast, shipbuilding was carried on, initially by the Golconda rulers and their nobles, but later on Europeans also began to build ships here. Shipbuilding was mostly carried on at Masulipatam, Narsapur Peta and Madapollam. There was abundance of timber, especially teak, around these centres, it being floated down the river Godavari to both Narsapur and Madapollam.[77] Above all, there were plenty of iron near this coast. Abul Fazl, recorded the presence of iron in Indur and Nirmal, convertible into steel.[78] Iron was also available at Nagalvancha, Bimlipatam, and Mutapalee.[79] Methwold, in the second decade of seventeenth century, found that their vessels were built of very good timber and iron.[80] In the 1580s, Muhammad Quli used to send every year large ships of 600 tons, if not larger still built at Narsapur Petttai to Red Sea.[81] In the early seventeenth century, after the coming of the Dutch and English on this Coast, Narsapur became particularly noted as a shipbuilding and repairing centre. Methwold, in the second decade of the seventeenth century, noted that for the purpose of trade 'they build great ships, and good ones too, considered in their burthen and materials, but not comparable to ours for beautie, conveniencie, or defence, some of them not less than 600 tunns, substantially of very good timber and iron; whereof we have had upon some occasion good experience in careening the Globe, Salomon, and Clawe, in the river of Narsoporpeta'.[82] Similarly Schorer, in the same decade, noted that 'A place called Narsapur Peta lies about 10 to 12 leagues beyond Masulipatnam;...Here there is a river where the Moslems, the Portuguese, and also the Gentus, build their ships, because timber, iron, and other necessary materials are available, and wages are low'.[83] But there was a difficulty in bringing out ships built

or sheathed in Narsapur river, until the northerly monsoon began to blow in October.[84] Peter Floris, in 1614, found very large ship being built at Narsapur.[85] We have many references to shipbuilding and sheathing and repairing, of ships at Narsapur, especially in the English factory records. In 1638, a ship of 800 tons was built by Mir Muhammad Sayyid.[86] In 1668 English factor Jearsey had built a new ship of 200 tons, at Madapollam.[87] In 1670, Thomas Bowrey, described the sheathing of a vessel in the range of 1000 tons, at Narsapur.[88] Besides these, there are several example of shipbuilding by the merchants and nobles of Masulipatam at Narsapur.[89]

Shipbuilding was also carried out at Lahore; due to availability of timber from the Himaliyan region.[90] However it was not a sea port, and the nearest sea port, Thatta whose outer port was Bandar Lahiri, had little access to timber for building ships.[91] In 1594 and 1596, as already mentioned Akbar built two large ships at Lahore in the river Ravi, whose technological aspect has been studied by Irfan Habib in detail.[92] An immense quantity of iron in the form of nails, strips, rings, etc. was used in the construction of the first ship. However, we have no details of quantity of iron used in the second ship. Due to problem in transporting the first ship to Thatta, owing to shortage of water in the river, the building of the second ship was carried upon a barge, which in English parlance is **ship's camel**. It carried the ship in the sea and later on the barge was scuttled there.[93] Sea going vessels like *ghurabs* were also built in Kashmir, but these plied in the river Jhelum only.[94]

Indian shipbuilding technology impressed the Europeans, who adopted elements of it. However in shipping equipments and skills the Indians remained behind the Europeans and for observational equipment they mostly depended upon the European for supplies.[95]

NOTES AND REFERENCES

1. Abul Fazl, *Akbarnama*, ed. Agha Ahmad Ali and Abdu-r Rahim, Bib. Ind., 3 vols., Calcutta, 1873-87, Vol. III, p 9; Shireen Moosvi, *People, Taxation, and Trade in Mughal India*, New Delhi, 2008, p. 243; *The English Factories in India, 1618-69*, ed. William Foster, 13 Vols. Oxford,1906-27, 1618-21, p.106.
2. *AN*, III, p. 195; Ad. 27247, f. 285b; Shireen Moosvi, pp. 244-246.
3. *AN*, III, pp. 651-2, 715-6; for its technological aspects see Irfan Habib, 'Akbar and Technology' in Irfan Habib edited, *Akbar and His India*, Delhi, 1997, pp.144-6.
4. Khafi Khan, pp. 421-22. See also 'Narrative of Philip Midleton, a Youth belonging to the ship "Charles" alias "Fancy" which delivered to Lord Justices, the 4th August 1696', in S. C. Hill, 'Episodes of Piracy in the Eastern Seas', pub. in *Indian Antiquary*, 1919, pp. 225-26

5. For detailed involvement of Mughal Emperors, Princes and Princess and nobles in shipping, see Shireen Moosvi, pp. 243-274; and Satish Chandra, 'Commercial Activities of the Mughal Emperors during the Seventeenth Century', in *Bengal Past and Present*, vol. LXXXVII, July-December, 1959, pp.92-7.

6. For defferent types of boats and other vessels in Mughal Empire see A.J.Qaisar, 'Shipbuilding in Mughal Empire During the Seventeenth Century', *Indian Economic and Social History Review*, vol. V, No. 2, June 1968, pp. 149-170, especially pp.155-158.

7. The term is probably derived from the Malay ajong or jong. For the different characteristics of junks see Pierre-Yves Manguin, 'Trading Ships of the South China Sea. Shipbuilding Techniques and Their Role in the History of the Development of Asian Trade Networks', *Journal of the Economic and Social History of the Orient*, Vol. 36, No. 3 (1993), pp.253-280.

8. Up till 1500, in India there were two broad traditions of ship-construction '*dhow*' tradition which according to Archibald Lewis 'long-standing Indian design' and 'junk' or Chinese tradition which Lewis calls 'Chinese-Southeast Asian style'. For details of these traditions see Simon Digby, 'Maritime Trade of India, c. 1200 to 1500', in T. Raychaudhuri and Irfan Habib, eds.,*Cambridge Economic History of India*, vol. I, pp.125-159, especially 127-35; and Archbald Lewis, 'Maritime Skills in the Indian Ocean 1368-1500', *Journal of the Economic and Social History of the Orient*, vol.XVI, parts II-III, 1973, pp. 238-264, especially 247-249.

9. Peter Mundy, *Travels*, II, *Travels in Asia, 1630-34*, ed.R.C. Temple Hakluyt Society ,2nd series ,xxxv, London ,1914 II, p.30. According to Irfan Habib, (Irfan Habib, *Technology in Medieval India*, New Delhi, 2008, p. 109), "these 'junks', which counted among them some of the biggest ships in the world at the time, had immense main sails, and were designed to take the best advantage of favourable winds. This fitted them for voyage across the Arabian Sea and the Bay of Bengal, where navigation was governed by the monsoons; but also rendered them difficult to manoeuvre."

10. *EFI* 1661-64, p. 253.

11. Ad. 27247, f. 285b; Shireen Moosvi, p. 244-246.

12. Irfan Habib, ' Akbar And Technology', in Irfan Habib ed., *Akbar and His India*, New Delhi, 1997, pp.144-6;Irfan Habib, *Technology in Medieval India*, p. 109.

13. Shireen Moosvi, pp. 265, 272.

14. *Purchas His Pilgrimes*, Glasgow, vol. III, p. 396.

15. *EFI*, 1622-23, p.343. [Emanuel Butta, Master of the Blessing, in 1623, wrote in his account of his voyage from England, in company with the Discovery and Reformation that 'On the 19th they met a junk, built by Portuguese but manned by Gujaratis, on which account they dismissed her'.]

16. *EFI*, 1646-50, p.90.

17. See Hobson-Jobson, *A Glossary of Anglo-Indian Colloquial Words and Phrases and of Kindred Terms*, by Col. Henry Yule, and A.C. Burnell, new edition edited by William Crooke,London, 1903, s.v. junk; Thomas Bowrey, *A Geographical Account of Countries Round the Bay of Bengal, 1669 to 1679*, ed. R. C. Temple, New Delhi, 1993, p. 181, where term junk was used for Dutch vessel. Fryer used the term 'Portugal junks'

18. A. J. Qaisar, *The Indian Response to European Technology and Culture AD 1498-1707*, New Delhi, 1982, reprint, 2000, p.20.

19. A. J. Qaisar, pp. 20-21. 'a technique of making joints or seams tight or leakproof by forcing oakum between parts that are not thightly-fitted. Thus, caulking was actually the next step in European shipbuilding after the planks were joined together by any method in carpentry'.

20. *EFI*, 1668-69, p.79.

21. *The Voyage of Pedro Alvares Cabral to Brazil and India*, from contemporary documents and narratives. translated with introduction and notes by By William Brooks Greenlee, p. 105

22. Ludovico di Varthema, *The Travels of Ludovico Di Varthema in Egypt, Syria, Arabia Desert and Arabia Felix, in Persia, India, and Ethiopia, A.D. 1503 to 1508.* transl. from the original Italian edition of 1510, with a preface by John Winter Jones, and edited with notes and introduction by George Percy Badger, Hakluyt Society,1863, p.152.

23. Gasper Correa, *Three Voyages of Vasco da Gama, And His Viceroyalty from the Lendas da India Of Gasper Correa, Accompanied by Original Documents.* transl from the Portuguese, With Notes And An Introduction, by The Hon Henry E. J. Stanley. Hakluyt Society, 1869, p.241.

24. Abu'l Fazl, *A'in-i-Akbari*, ed. Nawal Kishor, Lucknow, 1882, II, p. 110; Thevenot, p. 148; Master, II, p. 115; Bowrey, pp. 55-6; Willam Hedges, *Diary*, I, p. 67; Hamilton, I, p. 379,, Pinkerton, 405-6;

25. *AN*, III, pp.651-2, 715-6; See Irfan Habib, ' Akbar And Technology', in Irfan Habib ed., *Akbar and His India*, New Delhi, 1997, pp.144-6; Irfan Habib, *Technology in Medieval India*, New Delhi, 2008; and Shireen Moosvi, p. 251.

26. *Darabnama*, BM Or. 4615, ff. 31a, 76b, 55a; Pl. 3/117 (*Akbarnama*, V & A); see also S. P. Verma, *Art and Material Culture in the Paintings of Akbar's Court*, Pl. lxxi.

27. For use of iron in China see Needham, IV, p. 467. The precise date of adoption of iron to fasten planks in China is not made clear in Needham's study, but appears to be present by the 8th century A.D. (Pierre-Yves Manguin, 'Trading Ships of the South China Sea. Shipbuilding Techniques and Their Role in the History of the Development of Asian Trade Networks', *Journal of the Economic and Social History of the Orient*, Vol. 36, No. 3 (1993), p.268)

28. A.J. Qaisar, pp. 23-27; Moreland ('The Ships of the Arabian Sea about A.D. 1500', *Journal of the Royal Asiatic Society of Great Britain and Ireland*, January 1939, pp. 63-74 and April 1939, pp. 173-92, especially p. 189) suggested the absence of iron was due to high cost of iron.

29. *India in the Fifteenth Century*, edited with introduction by R. H. Major, reprint Delhi, 1974, Santo Stefano, p.8.

30. Marcopolo, *The Book of Ser Marcopolo*, edited by Henry Yule, and revised by Henry Cordier, London 1903, vol. I, p. 102; Barbosa, *The Book of Duarte Barbosa*, reprint New Delhi, 1989, vol. I, pp.76-77.

31. *India in the Fifteenth Century*, Nicolo Conti, p. 27. 'they build some ships much larger than ours, capable of containing two thousand butts, and with five sails and as many masts. The lower part is constructed with triple planks, in order to withstand the force of the tempests to which they are much exposed. But some ships are so built in compartments, that should one part be shattered, the other portion remaining entire may accomplish the voyage'.

32. Tek Chand Bahar, *Bahar-i Ajam*, s.v. *dabousa*; see also, Shireen Moosvi, p. 248.

33. Peter Mundy, p. 30.

34. Alexander Hamilton, *A New Account of East Indies .... from the year 1688 to 1723*, ed. W. Foster London, 1739, reprint New Delhi 1995, I, p. 123.

35. *A'in*, I, pp. 144-45.

36. For shipbuilding at Swally see *EFI*, 1618-21, pp. 113, 314; 1637-41, p. 211; 1655-60, p. 313, 319; 1661-64, pp.24, 79; 1668-9, p.201; 1670-77, pp. ix, 39-40, 218, (two frigates namely *Hunter* and *Revenge* and ketch named *Phoenix* was built for the purpose of defense against the Malabars), 222-23 ('at the suggestion of Cursetji, she (the *Revenge*) was made broader and deeper than at first was contemplated and changes were also effected in the ketch Phoenix to make a better sailer of her'), 31(four large boats were built in 1670, for the service at Bombay), 44.

37. J. Ovington, *A Voyage to Surat in the Year 1689*, ed. H. G. Rawlinson, London, 1929, p.166.

38. *EFI*, 1668-69, p. 80. The English turned towards constructing ships in India on large scale and admired and adopted the Indian method of ship-construction after 1668, which Irfan Habib (Irfan Habib, *Technology in Medieval India*, p. 111) has called 'an unchronicled revolution in the Indian ship-building industry'

39. Shireen Moosvi, pp. 244- 256 and again pp. 257-274; see also EFI, 1655-60, pp. 301, 313, 319; in 1660, in Surat the number of ships increased about 400% in a span of ten years (A.J.Qaisar, p. 168); 1661-64, p. 24;1668-69, p. 201. etc.

40. Abdul Haqq Nihawardi, *Maasir-i Rahimi*, edited by M. Hidayat Hosain, Bib. Ind. Calcutta, 1910-13, p. 611;

41. *AN*, III, p. 31; Bayazid Bayat, *Tazkira-i Humayun* wa Akbar, ed. by M. Hidayat Hosain, Bib. Ind. Calcutta, 1941, p. 354; see also Shireen Moosvi, pp. 245, 246 - 247.

42. Blochet, Sup. Pers. 482, ff. 170a-b, 167a-8b, 132b; and for its translation and other detail see also Shireen Moosvi, p. 249-50 and Appendixes E, F and G at pp.255-6.

43. Shireen Moosvi, p. 266.

44. *EFI*, 1622-23, p. 310, the English wanted to buy or build four frigats in a year either at Surat, Baroch or at Gandevi; 1634-36, p. 136, the English factors first suggested the building a couple of frigates at Naosari or at Gandevi, but they did not wanted to depend on ' the inconstant promise of our perfidious Governor', shifted its construction to Daman; Alexander Hamilton, I, p.104; EFI, 1668-69, p. 65.

45. *EFI*, 1618-21, p. 119; 1634-36, p. 136.

46. Pieter van den Broeke, Surat Dairy, 1620-29, transl. W.H. Moreland, JIH, X, 1931, p. 240.

47. *EFI*, 1622-23, p. 310; 1661-64, p. 24-25; Mendelslo, p. 14.

48. Lahori, *Badshahnama*, II, p. 606.

49. We have many references to these places in English factory records, especially when the English built there vessels there, such as EFI, 1618-21, pp. 82, 83, 1624-29, pp. 85, 198, 218; 1634-36, pp. 98, 103, 107, 108, 109, 119, 136, 137-138, 147, 148, 177, 180, 217; 1637-41, pp. 42, 110, 240,243; 1646-50, pp. 90-91; Selections from Bombay, Home, I, p. 62. Abbe Carre (III, p. 725) also found at Bassein that 'There is also a ship-building yard, six vessels were now on the stocks under construction for the Governor, who has the monopoly of this business here, but can at his discretion give permission for it to anyone else.'

50. *EFI*, 1637-41, p. 209.
51. *EFI*, 1637-41, p. 227.
52. *EFI*, 1646-50, p. 90-91.
53. *EFI*, 1668-9, pp. 61, 65, 66, 75 (two partly built vessels were sent from Bassein to be fitted at Bombay to enrich the fame of Bombay), 79, 80; EFI, 1670-77, pp. 54, 74, 108, 132 (boat building was encouraged by adopting various measures and it was further encouraged by Portuguese order forbidding their merchants to let out vessels to any belonging to Bombay)
54. *EFI*, 1668-9, pp. 65, 66, 71.
55. Ibid.,, 1668-9, p. 75. 79,
56. *EFI*, 1670-77, pp. 30-31.
57. Ibid., 1670-77, p. 57, 159.
58. Selections from Bombay, I, pp. 62, 120
59. *EFI*, 1670-77, p. 108,
60. *EFI*, 1668-9, pp. 71, 201.
61. *EFI*, 1634-36, pp. 42-43, 44. See also Hamilton (I, p. 394) for problem in reaching the great ships on the shore.
62. C. R. Wilson, *The Early Annals of the English in Bengal*, London, 1900, vol. I, pp. 9,11, 12.
63. *EFI*, 1651-54, p. 92
64. *EFI*, 1661-64, p. 67.
65. Ibid., p. 70.
66. Ibid., p. 71.
67. Ibid., p. 294.
68. Ibid., p. 393
69. Ibid., p. 401.
70. *EFI*, 1668-9, p. 308.
71. Bowrey, pp. 161-63.
72. *Ain*, II, p. 51; Manrique, II, 123; Hamilton. Pinkerton, p. 416.
73. Willam Hedges, Diary, I, p. 172.
74. Hamilton, I, p. 379.
75. *Ain*, II, p. 51; Atlas, p. 48.
76. Willam Hedges, Diary, I, p. 67 (Hills afford store of Iron, which furnishes all this country); Hamilton, I, p. 379,, Pinkerton, 405-6;
77. *Relations of Golconda in the Early Seventeenth Century*, a collection of the 'relations' of Methwold (1-50), Schorer (51-65), and an anonymous Dutch factor (67-95), ed. and transl. W. H. Moreland, Hakluyt Society, London, 1931, p. 80; Hamilton, Pinkerton, p. 397, 398; Bowrey, pp. 99, 102; Atlas, p. 62; Sanjay Subrahmanyam, ' A Note on Narsapur Peta: A " Syncretic" Shipbuilding Centre in South India, 1570-1700', *JESHO*, vol. 31, No. 3, 1989, pp. 305-311, especially p. 307.
78. *Ain*, II, p.110; see also Thevenot, p. 112; Fr. Martin, extracts tr. Ray, Islamic History & Culture, 38; Atlas, p. 62.

79. Master, II, p. 115; Thevenot, p. 148; Bowrey, pp. 55-6. (Bowrey noted that 'iron, steel' was brought down from 'Montapolee' in the high land behind Nizampatan).
80. *Relations*, p. 36. see also p. 63.
81. Sanjay Subrahmanyam, 'Persians, Pilgrims and Portuguese: The Travails of Masulipatnam Shipping in the Western Indian Ocean, 1590-1665', *Modern Asian Studies*, vol. 22, No. 3, 1988, pp. 503-530, especially p.505; Subrahmanyam, 'A Note on Narsapur..', p. 307. Accordingly, Sanjay Subrahmanyam, infers that the '*nao mourisca*' "in the style of Mecca", and others sent from Masulipatnam to Pegu in the 1580s and 1590s were built at Narsapur (Sanjay, 'A Note on Narsapur..', pp. 306, 307).
82. *Relations*, p. 36. The globe was refitted at Narsapur so as to be "a far better ship than when she first came out of England". (*Letters Received*, II, p. 41)
83. Ibid., p. 63.
84. Ibid., Anonymous, p. 80.(the river was southern or Vasishta, mouth of the Godavari)
85. Peter Floris, p. 125-33
86. *EFI*, 1637-41, p.
87. *EFI*, 1668-9, p. 164 (see also *EFI*, 1661-64, p. 391 for convenient place of shipbuilding and repairing at Madapollam)
88. Bowrey, pp. 90-102.
89. Subrahmanyam, ' A Note on Narsapur..', pp. 305-311.
90. *Akbar and Technology*, p. 144.
91. *AN*, III, p. 716; *Akbar and Technology*, p. 144. However timber floated downstream on the river Indus to Thatta. (*EFI*, 1634-36, p. 244; *Atlas*, p. 16)
92. *AN*, III, pp. 651-2, 715-16; *Akbar and Technology*, pp. 144-46.
93. *Akbar and Technology*, p. 145.
94. *AN*, III, pp. 727-28; *Akbar and Technology*, p.146.
95. For instruments used on Ships and lagging behind of Indians in this field see A. J. Qaisar, '*The Indian Response....*'pp. 27-37; and Irfan Habib, *Technology in Medieval India*, pp. 107-112.