O) Water Transport

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1. Introduction

Water transport includes all kinds of vessels from canoes to container ships. It thus covers those carrying passengers and goods, in urban and rural areas, and whether motorised or non-motorised. This section focuses on inland water transport – on rivers, canals and lakes – while including some consideration of coastal and inter-island vessels, but it does not deal with ocean-going or inter-country transport. It considers not only the vessels themselves but also the waterways, the docking facilities, and the planning, financial and regulatory regimes within which water transport operates. It is as broad in its coverage of water transport – its vessels, technologies, purposes and sites – as are all the sections combined that deal with equivalent aspects of land transport. Consequently, it can only briefly cover the many issues to be considered, and so you may wish to consult the further information sources listed at the end of the section to find out more.

Water transport is an important (and sometimes the only) form of transport for people and goods in many parts of the developing world, and some examples illustrate this. Bangladesh's 1.5 million 'country boats'

Figure 3.59 A floating market in Bangkok

Picture Credit: Dennis Jarvis.

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provide the only reasonable transport for an eighth of the nation's rural population, and are a significant form of transport for a much larger proportion.[1] In the Mekong Delta 90% of rice exports depend on river vessels.[2] Water transport provides a lifeline for Amazonian communities in eastern Peru, for folk living around the lagoons behind Nicaragua's Atlantic coast, for the floating Kampong Lourng commune of Cambodia, and for fishing villages on islands in Uganda's section of Lake Victoria. It is also vital for island-to-island and inland transport in Indonesia, and for the farmers and fisherfolk of southern Côte d'Ivoire. Rivers are the sites of floating markets on the Mekong, and a critical link in passenger and freight (even container) transport networks in China. In Vietnam annual river boat passenger numbers grew by 10.7% between 1995 and 2000, reaching 175 million, and in the Moc Hoa region of the country there are estimated to be a million boats.[3]

Bangladesh has 24,000 km of rivers, of which 6,000 km are navigable in the wet season.[4] Amazonian Peru has 9,000 km of navigable rivers,[5] while estimates of navigable waterways in the Mekong Delta range from 6,000 to 27, 000 km.[6]

Yet in spite of the critical importance of water transport to many communities in the developing world, and to national economies, it tends to be a highly neglected part of transport systems.[7] It is often seen as outmoded, and is therefore poorly documented and researched, and lacks the official attention and resources it deserves. This can become a vicious circle, as a lack of awareness of its importance, its problems and its potential lead to deteriorating water transport facilities, which in turn leads to fewer users and then to even less government attention and support.

However, this situation is likely to change as the advantages of water transport come to be recognised. And these advantages are clear:

- The waterways necessary for water transport are generally already in place, and improvements to them can usually be made at much less cost than can improvements to road and rail infrastructure.
- The development of waterways is not likely to damage sensitive coastal, riverine, wetland and forest areas in the ways that land-based transport infrastructure can.
- Many forms of water transport uses less fuel and emits fewer pollutants and greenhouse gases, given equivalent loads and technologies, than land-based vehicles do (although other forms do not have such a good record and need to be improved, as shown in Chapter 2).
- There is great potential for water-based freight transport, particularly containerised freight, as part of an efficient, sustainable, multimodal freight system.
- As carbon comes to be priced globally, and as public and private funds are increasingly channelled into more sustainable forms of transport, a greater proportion of such funds are likely to be directed to improvements to water transport.
- Finally, given that communities highly dependent on water transport tend disproportionately to be poorer communities, their governments – if they are committed to lifting the living standards of all their citizens – have little choice but to improve these transport facilities.

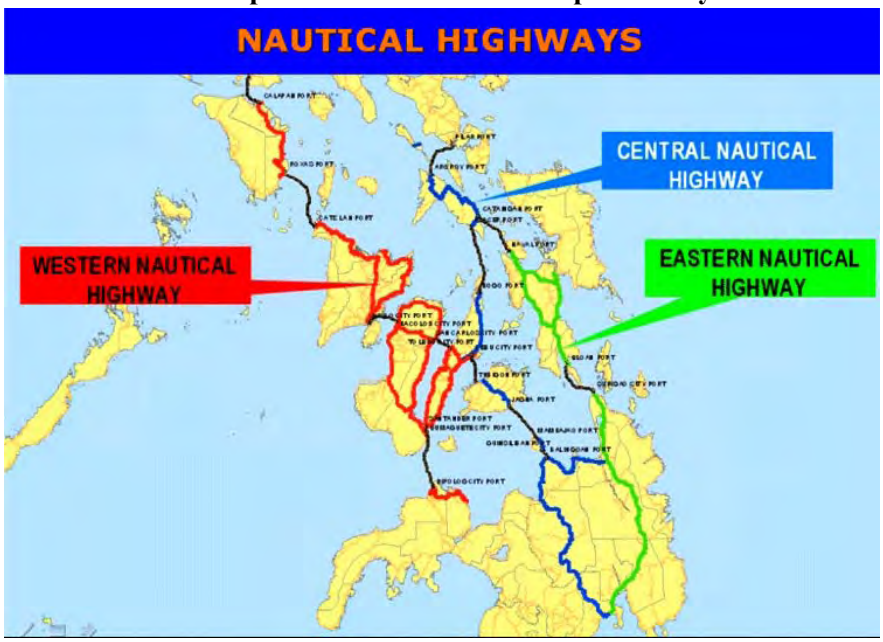
2. Development Contribution

Economic

It is much less expensive to improve existing waterways than it is to build new roads and other land-based transport infrastructure, especially when one considers the cost of both land acquisition and construction.

In some localities road construction can be especially expensive, for example, in the Moc Hoa region of Vietnam because the soil bed is soft and road construction materials have to be transported a long distance.[8] However there are costs for improvements to water transport infrastructure, including for docking facilities for passenger and freight vessels and for transfers to other modes, channel maintenance and improvements, locks, regulation of water levels, provision of adequate bridge heights to allow boat clearance, and possible linking of waterways (e.g., see Figure 3.60). But when such improvements are made they can contribute substantially to economic development.

Figure 3.60 The Philippines' Strong Republic Nautical Highway (SRNH) is a network of multimodal transport routes that connect up the many-island nation



Source: Government of the Philippines[9].

Investment in keeping waterways in good condition does not just advance transport objectives. It also furthers many other objectives that all have an economic impact. These include water provision for agricultural, industrial, domestic and civic purposes; power generation; flood control; fishing; recreation; beautification; and tourism. Many specific measures to maintain and improve waterways will advance multiple objectives at the same time, for example, measures to prevent bank or shore erosion, to remove obstructions, to prevent water pollution, to regulate maximum and minimum water levels, to ensure adequate land access to waterways, and to put in place management regimes that simultaneously allow for different uses of waterways.

In cases where water transport uses less fuel than equivalent land transport – such as in modern freight – this means cost savings. Sometimes water-based passenger or freight transport charges are higher than land-based charges, but this is largely because road transport providers do not have to meet the significant costs of road construction and maintenance and are thus publicly subsidised.

Water transport is vital to the economic wellbeing and development of communities for which alternative transport modes are few or non-existent, and a disproportionate number of such communities are poorer than average.[10] In countries with high rainfall, roads may be impassable in the wet season.[11] Water transport enables farmers, fisherfolk and artisans to obtain supplies and get products to market, and is

vital for many construction, mining and forest industries, as well as for traders, commuters and consumers in communities located on waterways.[12] Water transport is also a key source of employment in itself, for example, employing 60% of Bangladeshis working in the transport sector.[13] And the income of communities living close to water can be supplemented by water-based tourism.

And though water transport has a reputation for being slow, this is not necessarily the case. For example, the average speed of a rail freight wagon in Asia is often slower than that of a freight barge,[14] vehicles on unsealed roads are often no faster than boats,[15] and the longtail boats of Thailand, Cambodia and Peru can carry passengers and goods at great speed.[16] Many rivers run through or close to cities which means that they are close to markets and production sites. And water transport often benefits from lower insurance premiums because there is less theft and breakage.[17]

In contrast to cars and other land-based vehicles, boats of many kinds and sizes can easily be manufactured domestically, often by local artisans, even if the motors that power them need to be imported.

Social

The same water transport that enables often poor communities to advance themselves economically also enables them to access education, health care and other services. In Vietnam water ambulances bring health services to remote villages, and other vessels take children to and from school. In the Amazon forests of Brazil floating courts bring justice services to isolated communities.[18] Water transport is responsible for fewer accidents. Rivers and other waterways are also important to communities for spiritual, aesthetic and other cultural reasons, and so protection and maintenance of those waterways and the provision of good transport services on them is in keeping with their cultural significance.

Environmental

The low fuel use of much water transport means less emission of greenhouse gases and pollutants. In Bangladesh the use of water-based instead of land-based transport is estimated to save 58.5 million litres of diesel and reduce carbon dioxide emissions by 155,000 tonnes per year.[19] Less infrastructural development means less resource and energy use in construction, and fragile environments are not threatened as they can be with road construction. More transport on waterways means less traffic and noise on roads. For example, the Thai Government has expanded commuter services on waterways around Bangkok to relieve the extreme road traffic congestion.[20]

3. Greenhouse gas emissions reduction potential

As indicated, the size and characteristics of water transport vary enormously, and thus general statements about current greenhouse gas emissions or the potential for reducing these cannot be made. The two main types of vessels to be considered here are passenger ferries and cargo ships, and they present contrasting pictures. As figures in Chapter 3 indicate, ferries actually have quite high emissions per passenger. For example, in low-income Asia, ferry energy use – which correlates with greenhouse gas emissions – per passenger (2.34 MJ/pass-km) is higher than for private car passengers (1.78 MJ/pass-km), and energy use per passenger for ferries in this region are actually the least in all regions cited, with Western European ferries using the most energy per passenger (5.66 MJ/pass-km). However, ferries often use very old technologies and do not carry sufficient passengers to make them a viable option. Therefore there is potential for significant reductions in energy use in boats, as is discussed later. On the other hand, efficient water freight has much lower energy use and greenhouse gas emissions than land-based freight. For

example, Australian coastal shipping is responsible for 22% of the country's freight movement by volume but emits only 4% of all freight transport's greenhouse gases[21] (although it should be acknowledged that boat sizes are likely to be smaller on average on inland waterways and therefore the efficiencies may not be as great). Smaller boats are either non-motorised or have only small motors so their greenhouse gas emissions are not great.

4. Steps to be taken to improve water transport

As has been described, there are many economic, social and environmental benefits to be derived from water transport. However, for it to maintain and increase its share of transport journeys, and for those journeys to be faster, more efficient, more pleasant for passengers, and more sustainable, a range of things need to happen.

Improvements to waterways

Waterways can be obstructed by the hand of nature or humans. An example of the latter is the Sukkur barrage on the Indus River in Pakistan which has no lock and this prevents vessels travelling from the sea to Kalabagh. (This is equivalent to a 2000 km highway being rendered unusable for long-distance traffic by one obstruction.)The Farraka barrage in India constituted the same problem but a lock has now been built, as has one between China's Southern Grand Canal and the Qiantang River.[22] The following kinds of improvements may be required to make waterways navigable:

- dredging and channel widening, and marking (or improved marking) of channels
- maintaining banks or shores

Figure 3.61 Bridge heights must account for rising water levels and different size boats

Picture Credit: David Long

- ensuring bridges built over waterways are high enough to let boats pass under, even when waterways are at their highest level, and allowing for growth in vessel sizes
- flood control, and ensuring that water levels are high enough for navigation in dry seasons
- ensuring that passage along waterways is not blocked by irrigation and water management structures, and locks are provided where necessary
- linking of waterways where necessary.

UNESCAP has produced a useful manual with details of the dimensions of waterways, locks and bridge clearances that are required for vessels of particular dimensions, as well as much other relevant practical information.[23]

Development of freight facilities

In countries with navigable inland or coastal waterways close to population and production centres, it makes economic and environmental sense to incorporate water freight transport into multimodal freight transport systems, along with rail and road freight. Boats will rarely be able to carry freight from source to destination, so one or more other modes are required. The efficiency, speed and cost of such multimodal transport , and the degree to which it can compete with less sustainable road-only freight transport, will depend on the dock facilities for transferring freight from one mode to another, and these facilities include the quay apron, the gantries or cranes, and the space and facilities for road or rail transport. Some ports, such as the Pearl River Delta, can operate without cranes because the barges themselves can transfer the cargo.[24]

It is desirable to have docks located away from the densest urban areas so that road and rail freight do not add to urban congestion. Water terminals can be part of major freight centres that are discussed in the freight section of this guidebook. With modern phones, GPS and other information and communication technology, it is easy to track water freight movements, to communicate with vessels and terminals, and to have direct contact between boat operators and customers. The use of e-commerce technology also increases the visibility of water transport in the marketplace.[25] Technologies like radar and GPS can make night navigation more possible and allow water transport to be faster over the duration of a trip and thus more competitive with land transport.[26] Multimodal transport facilities also need logistics technology to ensure that, for example, vehicles and vessels are as fully loaded as possible (including on return journeys) and trucks take the shortest, least congested routes. Logistics is also covered in the Freight transport section of this book.

The efficiency of water freight also depends on the extent of containerisation. Many developing countries with extensive waterways have little or no containerisation, but in China, for example, it increased fourfold between 1998 and 2001.[27] India's rivers are said to also have great potential for the further development of containerised freight transport, and it is a distinct possibility for many other developing nations.[28] The rapid growth of containerised freight on the rivers of Western Europe in recent years strongly suggests that this mode has a bright future,[29] and there is thus potential for containerisation to grow in any country that has extensive waterways near population and production centres.

In some locations, such as the Amazon region of Peru, more basic improvements to freight loading and unloading facilities are needed – not containers and gantries, but small cranes and better docks and freight storage facilities to replace the makeshift facilities that currently exist.[30]

Passenger boats

Because there has been little official attention given to water transport, standards can be very low, and this certainly applies to passenger boats. Common problems are overcrowding, a lack of safety and environmental standards, poor conditions at docks and for boarding and alighting, and poor or non-existent toilet facilities on boats and docks. Women and elderly people may be reluctant to travel for these reasons.[31] Ferry engines are often inefficient or poorly maintained, and thus may emit high levels of greenhouse gas. There is a need for regulation and support to improve all these areas. It may be necessary to subsidise water transport services and improvements to them, as many customers may not be able to afford the fares of an unsubsidised service, and it must be remembered that private and public land-based transport is generally subsidised in some way. Governments may also need to investigate whether the supply of passenger boats in water-based communities meets the demand and – if it does not – they may need to provide these services themselves or contract or assist private operators to do so.

Figure 3.62 Boats of all shapes, sizes and purposes are part of the fabric of life in Dhaka, Bangladesh

Picture Credit : Karl Fjellstrom (left) Ahron de Leew (right).

Development of technologies and local manufacturing

Boat engine technology can benefit from the same sorts of advances in efficiency and in the use of more sustainable fuels to power it as can technology used in land-based vehicles (as described in the Other engine technologies and fuels section). For ocean going vessels, it has been estimated that a combination of existing knowledge and emerging innovations can yield up to 80% reductions in energy use, through options like fuel cells, anti-fouling coatings, improved hull design, air floatation, propeller design, harnessing wind for propulsion, and the use of renewable energy in ports.[32] Some of this will be applicable to larger coastal and inland vessels. Solar-powered boats are being developed and applied in diverse situations.[33] An example of this on a small scale is the introduction by a Bangladeshi organisation, Shidhulai Swanirvar Sangstha, of a series of locally-made boats powered by photo-voltaic panels that visit poor, remote communities. The boats function as classrooms and libraries, and bring to these communities health and agricultural training, low-interest loans, and access to mobile phones, the internet, and basic solar-powered home technologies (Figure 3.63).[34]

Local manufacturing is more feasible for boats than it is for most land-based vehicles, even if imported engines have to be added, and it can be encouraged by government and community agencies through training and low-interest loan schemes.[35]

Figure 3.63 Boats supplied by Bangladesh's Shidhulai Swanirvar Sangstha function as children's classrooms, but also provide learning and facilities for adults

Picture Credit: Ashden Awards

Documentation and research

As has been noted, water-based transport has tended to be under-valued, under-recognised and unsupported by government. A major task, therefore, is to reverse this trend, starting with greater attention to documentation and research in each country in which water transport is, or might be, a significant mode. This needs to include attention to:

- the extent and types of water-based transport
- its social, economic and environmental advantages
- the problems it faces, including safety and environmental problems, and how these have been addressed in different countries and localities
- the degree to which supply matches demand
- to the extent that it doesn't match, how this can be assisted to occur, drawing on experience from around the world.

Planning, coordination and regulation

For water transport to work well, three sorts of integrated planning are necessary:

- **Integration across connected waterways,** which may include lakes, coastal waters, canals and different river catchments, bearing in mind that most of these are natural water systems that may cross (or form) the boundaries of regions, states and nations. Such integration should aim for the harmonisation of navigation aids, laws, regulations and capacity to carry vessels of certain dimensions. This may lead to linking waterways, adding locks and re-building bridges to achieve greater clearance.
- **Integration across transport modes,** so that passengers and freight can switch quickly and efficiently from one transport mode to another for different legs of a journey.
- **Integration of different water uses** in a way that allows all of them to function effectively and sustainably, and in the context of this section, does not see water transport as less important than other water uses, or as less important than land transport routes that span waterways via bridges. It

is also necessary to clarify who is responsible for building locks when dams and irrigation barrages are constructed.

WaterWiki.net suggests the creation of a Masterplan for an Inland Transport System, and Zoran Radmilovic has outlined ten key areas for such a plan, while the Philippines has developed a 'Nautical Highway System' (Figure 3.60).[36] All this requires coordination between different levels of government, different governments at the same level, and different government departments, as well as between government, business and community organisations.

Between 2000 and 2002 the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Mekong River Commission undertook a study on the harmonisation of navigation aids on the Greater Mekong River and made recommendations that involved the governments of Indochina as well as China.[37] UNESCAP has also proposed a trans-Asia transport network, integrating rail, water and road transport modes. While integration between levels of government is vital, there is also a need for flexibility with regard to the most appropriate level of government to deal with water transport in particular regions. For example, in the Amazon region of Peru, which is geographically isolated from the capital and the more populated west of the country, more local governance of water transport is important because it can draw on local knowledge and is likely to respond to local concerns more readily and effectively.[38]

Because water transport tends to be officially ignored and is therefore under-regulated, boats can be very unsafe and conditions on them poor compared with land transport. Proper regulation of waterways, vessels, drivers and dock facilities – and especially of larger passenger and freight vessels – can enhance safety, quality control and environmental standards (including reduced greenhouse emissions), and protect the rights of consumers, boat owners, employees and other water users.

5. Costs and sources of finance

Vessels, whether passenger or freight, are normally owned by companies or individuals, in which case this is not a cost to the government. The cost of docking facilities can vary greatly because the facilities and technology involved are highly variable. Government may consider contracting out the building and operation of docking facilities to private businesses. Water transport is able to compete better with road transport, and thus operate more profitably, if road users pay a greater share of the costs of road building and maintenance and other road transport related costs. Some of the extra public funds thus generated can be used to improve water transport infrastructure such as docking facilities. Overall, though, water transport routes are much cheaper to maintain and improve because the waterways are mostly pre-existing natural features that require little upkeep. For example, in Vietnam the cost of dredging a waterway is about one-seventh the cost of rehabilitating a road.[39] The operating costs of water transport may need to be publicly subsidised on an ongoing basis as it is in China, Europe and the United States – but this is little different to the situation with road and rail transport. Water transport has been strongly supported by the World Bank – for example, in Bangladesh, China, Thailand and Vietnam[40] – and other multilateral funding sources discussed in Chapter 4 can also help to finance it.

When it comes to costs associated with smaller vessels, many individuals are able to afford these. In Vietnam, for example, a family boat with a new engine will cost about the same as a new motorcycle, while a second-hand motorised boat will cost about half that.[41] Others may need assistance through low or no interest loan schemes for small and micro businesses. It is reasonable for water transport users to contribute some of the funds necessary for improvements to waterways. As well, other non-transport users of waterways can also contribute to the costs of maintaining them, for example, hydropower companies

Figure 3.64 Hong Kong ferries provide low cost public transport. With efficiency improvements ferries can also become a more low-carbon form of transport

Picture Credit: www.workinginhongkong.com.

or consumers or, as in Vietnam, farmers, through the irrigation fees they pay, and these farmers also help to clear and dredge small waterways.[42]

6. Conclusion

Water transport cannot be ignored. Whether carrying passengers or goods, it is an important component in the mix of transport modes in many countries, and an essential form of transport for communities – often low-income communities – that live around waterways and have little access to other modes. Though the efficiency of water transport varies greatly, on average it has the potential to emit less greenhouse gas per passenger or unit of freight than do private passenger and freight vehicles. Water-based freight can be an efficient, low carbon component of a multimodal freight system, as is being demonstrated from Europe to China. Moreover, the waterways on which water transport operates are already in place and require little improvement or maintenance, and therefore their cost, greenhouse gas emissions and local environmental impacts are small in comparison to land-based transport routes.

The smallest boat with the simplest technology can be efficient and appropriate in its context, but for motorised water transport there is frequently a need for more efficient engines, better boat designs, and the adoption of lower carbon fuels and even electrics. This will happen much more broadly and effectively if governments take more notice of water transport and provide more support. Government have important roles to play: in any necessary improvement and maintenance of waterways, in setting standards and regulations, in facilitating coordination with other transport modes, and in providing financial support and

information. Funds can be obtained from multilateral sources, including new funds flowing from carbon pricing arrangements. If water transport does not get the recognition and support it needs, passengers and freight are likely to increasingly shift to less satisfactory and often less sustainable land-based modes, or simply put up with less than adequate services. There is great potential for water transport to be a more efficient, more low-carbon transport mode, and governments have a key role in enabling this to happen.

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