ADB

INRM Policy Brief No. 13

Viability of Inland Water Transport in India

Narayan Rangaraj and G. Raghuram

Asian Development Bank

India Resident Mission Policy Brief Series

Asian Development Bank
India Resident Mission (INRM)
4 San Martin Marg
Chanakyapuri
New Delhi 110021

Indian Institute of Management, Ahmedabad, is the Implementing Agency for the thematic cluster 'Transport Infrastructure Development: Priorities, Constraints, and Strategies'.

INRM Policy Brief No. 13

Viability of Inland Water Transport in India

Narayan Rangaraj and G. Raghuram

2007

Narayan Rangaraj is Professor of Industrial Engineering and Operations Research at the Indian Institute of Technology, Bombay.
G. Raghuram is Professor in the Public Systems Group at the Indian Institute of Management, Ahmedabad.

Foreword

The India Resident Mission (INRM) Policy Brief Series is sponsored by the Asian Development Bank (ADB) and is designed as a forum to disseminate findings from policy research work undertaken on the Indian economy. The series is primarily based on papers prepared under the Technical Assistance (TA) 'Policy Research Networking to Strengthen Policy Reforms in India'. The main purpose of the TA was to provide assistance for developing policy research networking capacity, in order to build support for, and consolidate the reform process. The INRM Policy Briefs provide a nontechnical account of important policy issues confronting India.

Tadashi Kondo
Country Director

Viability of Inland Water Transport in India

Narayan Rangaraj and G. Raghuram

In water-based transport generally, fuel costs are low and environmental pollution is lower than in transport by road, rail, or air. The waterway is naturally available, which has to be 'trained', maintained, and upgraded. Water-based transport is especially effective when the source and destination are waterfront locations. Transport based on inland waterways (or inland water transport, IWT)—rivers, canals, lakes, etc. and also overlapping coastal shipping in tidal rivers—constitutes 20% of the transport sector in Germany (WB 2005) and 32% in Bangladesh (Rahman 1994). In India it has a paltry share of 0.15% (Raghuram 2004).

IWT has received large funding in both the ninth and tenth five-year plans but has not been able to effectively utilize it (Planning Commission 2001). It continues to be a significant focus area for investments, such as a Rs 300 crore investment planned by the Asian Development Bank (ADB) (Indian Infrastructure 2004). It is an important component of the National Maritime Development Project (NMDP). This policy brief assesses the viability of IWT in India. The detailed report (Rangaraj and Raghuram 2005a) is available online.

In IWT policy formulation the following questions may be asked:

- Should government invest in IWT? How much and where?
- What is the role of the major institutions in this area (the Inland Waterways Authority of India—IWAI—foremost)?

- What policy instruments are available to government to regulate and support the sector at an 'appropriate' level?
- Who are the major stakeholders in IWT and does policy take into account their concerns?

Three major waterways have been designated as National Waterways: the Ganga-Bhagirathi-Hooghly system, from Allahabad to Haldia, NW-1; the Brahmaputra system in Assam, NW-2; and the west coast canal system in Kerala, NW-3. Commercially, the small tidal river system in Goa, comprising the Zuari and Mandovi rivers and the Cumbarjua Canal is the most important. River inlets along the coast, especially near ports, and some canal systems as part of larger water resource development projects also appear viable as part of IWT. The river interlinking project in the country, if it comes about, opens up further possibilities.

Passenger Movement

IWT-based passenger movement is mainly by ferry across rivers, on short stretches along rivers, and tourism-based passenger traffic (in Goa, Kerala, Sunderbans, and northern regions). For details, see the statistical summaries produced by IWAI, the Ministry of Shipping, the Planning Commission working group on IWT, and state-level authorities like West Bengal (TRW 2001; TRW 2002), Kerala, etc. Among factors that affect passenger movement are the following:

Travel Time. With construction of bridges, travel time by land is generally reducing. Faster ferries and launches can make IWT competitive.

Cost. The total cost of ferry plus subsequent mode of transport needs to be taken into account in planning.

Interchange Convenience. Waterway transport should be able to move seamlessly to other modes, e.g. bus and train. A study in the Kochi metro area, which suggests that IWT cannot be ignored in the future growth of the city, calls for integrated investments to increase complementarities with other modes, faster vessels, unified pricing, ticketing, and targeted subsidies. Mumbai has experimented with hovercraft (apart from continuing ferry), but a sustainable service mix has not been found.

Inland waterways provide a convenient function in related activities, such as carriage of vehicles, tourism, and water sports.

Carriage of Vehicles (preferably in roll-on-roll-off mode). West Bengal, Kerala, and Goa have significant number of these ferry services, but a great potential exists, with faster boats, proper landing facilities, and interchange with other modes.

Tourism, Including Stay and Entertainment. In Kerala, Alapuzha, and to a smaller extent Kozhikode, are centers of this activity, especially for houseboats. Boats that provide music and dining are flourishing in Mumbai, Goa, and Kochi. River cruises, scheduled and chartered, are also available (Outlook Publishing 2004).

Water Sports. This new sector has possibilities in north and east Indian rivers. White water rafting and trekking on iced mountain stretches of rivers are examples (CMYK 2005).

Cargo Movement

Movement of commodities like tea, jute, and spices in the eastern sector, connected to the river port in Kolkata, was among the early commercial drivers of preindependence India. Logistical convenience of river transport, which used to be a determining factor in the location of industrial activity, may be less so today, though access to water for processing and in some cases effluent treatment is still a consideration in location.

Growth in this sector has been sluggish, with the outstanding exception of the tidal river-canal system in Goa, where the Mandovi-Zuari-Cumbarjua system moved some 30 million tons of iron ore in 2003-4 (GMOEA 2004).

IWT-based cargo movement becomes viable if technological and physical viability and commercial potential exists and operating policies of carriers and associated agencies are conducive. Some factors that affect operational economics are the availability of right-of-way (waterway); carriers (navigational vessels); terminal facilities (jetties and ports), and managerial and supporting infrastructure systems.

Technological and Physical Viability

Water Flow. In the main waterways, water flow may have decreased over the years because of increased drawing on water arising from habitation and industrial and agricultural needs. Damming may also have brought down the extent of regular flow.

River Training, Dredging, and Navigation. To consistently provide a sufficient depth for plying draft may require maintenance of banks and periodic riverbed dredging. Cost estimates of river training on the Sabarmati are about Rs 10–11 crore/km (SRFDCL 1998). In rural areas the figure could be lower at say Rs 8–9 crore/km.

IWAI in principle—but not in practice—commits to maintaining a year-round draft of 2 m along the National Waterways (Planning Commission 2001). The deficiency could be overcome either by justifying the cost on the basis of assessed commercial traffic potential or by the operators planning for a realistic draft of 1.5 m.

Navigation requirements are channel markings, night navigational aids—including the possible deployment of global positioning system (GPS)—and river maps and charts. The National Inland Navigation Institute (NINI) at Patna has been assigned the task of developing the use of appropriate technology.

Locks. Where the physical drop of the river channel is excessive locks have to be provided to manage the height differential. (The planned Three Gorges Dam on the Yangtze will have five locks for descent.—www.travelchinaguide.com)

Access of Cargo. The cargo has to be accessible to the waterway at both ends, to ensure door-to-door movement.

Availability of Vessels and Associated Infrastructure. Private operators have a substantial fleet but have of late been scrapping vessels. Governmental help may be required to encourage them to invest in fleet maintenance and growth. The role of government-owned shipyards is important in this domain, including the Rajabagan Dock Yard in Kolkata owned and operated by the Central Inland Water Transport Corporation (CIWTC). CIWTC can provide repair facilities for other operators in the area as well. There is also a well-established industry of manufacture, maintenance, and repair of barges in Goa, some of which are operated by mining companies.

Commercial Potential

Aggregate assessments of traffic have been made by the Ministry of Shipping, the IWAI, and the Planning Commission. Disaggregate

assessments are also available for NW-1 and -2 and Kolkata Port Trust region.

Freight handling in IWT involves movement to and from the water mode, including loading and unloading of material, and storage. IWT offers medium batch size possibilities, slow but secure movement, limited door-to-door opportunities, and cheap rates. In comparison, road offers small load options, faster movement, door-to-door service, but higher rates. Rail offers large batch economies, quick movement, partly door-to-door service, and medium rates.

The geographical advantage of freight transport by IWT is strongest if the entire movement is across a river. The next level of advantage is when one or both terminal points are near a river. For transport of material (construction material and equipment) relating to a particular river-based project activity (e.g. river bridges, hydroelectric plants), IWT is most attractive.

By far the biggest example of industrial customers with regular demand is iron ore export from mines in north and south Goa over the Mandovi and Zuari. Movement of ore from Karnataka, after blending, is another source. FACT in Kerala has been a steady customer for most of its raw materials. Potential traffic is from oil refineries in the North East (Numaligarh, Dibrugarh, and Digboi), oil refineries elsewhere on riverbanks such as Haldia and Barauni, and thermal power plants, for bringing in coal and carrying away fly-ash at locations like Barh and Bandel. Thermal power plants in Ahmedabad, Bhusaval, and other river locations cannot use IWT because draft is only seasonally available.

Custom from small customers with regular demand, based on agriculture or manufacture of commodities and meant for consumption or processing within the country or for export, is slowly increasing, going by the estimates of CIWTC (CIWTC 2004a) and other barge operators in NW-1. High-value movements, such as of machinery and equipment on river-based projects, has also proved a viable activity for bridge building.

External trade through oceangoing liners is another good candidate for IWT. At Haldia port the river system is connected to the port operation and barges can unload directly to oceangoing vessels, provided customs formalities can be carried out without entering the port. The cost savings are likely to be significant.

The trend, however, as in Kerala, has been for the traffic to shift from IWT to other modes in the last decade.

Operational Viability

Cost. IWT is a capital-intensive industry. Significant investment is required in vessels. Providing and maintaining the waterway and terminals requires even higher investment. Operating costs can involve vehicle costs, fuel costs, crew costs, maintenance costs, and loading/unloading costs. Contingency costs include running aground and damage to vessels.

Systems Perspective. Rangaraj and Raghuram (2005b), emphasizing the systems perspective, draws on illustrative examples from Goa and NW-1. It proposes a model for identifying the range of viable operations from the point of view of (i) the competitive fare provided by other modes, (ii) the size of barge and therefore the operating cost, (iii) the desired throughput, and (iv) the total cost to the customer.

Fleet Planning. Barge operations rely on economies of scale. Larger barges require larger water depth, have lower operating costs but higher inventory staging costs. They may also have operating restrictions. Small barges, on the other hand, may congest traffic. A range of sizes offer a better choice.

Scheduling. Scheduled runs have the systemic advantage of more certainty for customers, routine vehicle deployment, and control of operational costs. Chartering provides for more responsiveness and can reduce nonremunerative runs. CIWTC operates both types of services (CIWTC 2004b).

To summarize operational viability, barge economics is a capital- and scale-intensive activity. The preferred barge size in NW-1 seems to be about 750 tons, given an optimistic view of available draft (in insufficient draft the vessel has to operate below capacity). In Goa the preferred size is about 1500 tons; 2000-ton barges are also operated. In NW-1 smaller barges may need to be considered with more valuable commodities. Here, since IWT is unlikely to meet the servicing requirements a big market is doubtful initially. Agricultural export and project-related activity offer some volume potential.

Other Issues

Role of Agencies

A number of central and state agencies and stakeholders play a role in the regulation, operation, and sustenance of IWT. Among them are

IWAI, CIWTC and other operators, state governments, port authorities, transport development agencies, and customers.

IWAI's role as regulatory-cum-infrastructure provider needs to be sharpened. IWAI's main responsibility is the provision of an effective waterway at least on the National Waterway system. IWAI has taken on a limited role in the provision of some infrastructure at terminals (for example at Patna, Guwahati, and Kerala) and has also commissioned some medium-size barges.

A suitable model needs to be evolved for recovering service charges in IWT to maintain a desirable level of infrastructure.

An attempt can also be made to synergize coastal shipping with IWT. The major issues, which come within the ambit of central government control, are operating standards including vessel certification, safety, and personnel-related concerns.

CIWTC, based in Kolkata, being a loss-making organization, has been considered for privatization. Many of its large fleet of barges are not operative. Its Rajabagan Dock Yard and River Services Division also are not financially and operationally viable. Given the declining demand and CIWTC's large overheads its continued presence is not critical for IWT.

NINI has limited staff strength and has so far done training and certification and a few focused studies.

Experience of Other Countries

IWT experience across the world is varied and offers interesting comparisons. In the region, publications of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) on IWT give brief comparative pictures of India, Bangladesh, China, Indonesia, Thailand, and the Mekong river system. Published policy overviews on IWT also discuss measures such as standardization of navigation rules and modernization strategies through this forum. An initiative taken by Japan attempts to consolidate the knowledge base and facilitate exchanges of good practices on IWT.

In *Bangladesh,* about 35% of the freight movement is by IWT. River ports are quite well developed and competing modes (rail and road) are less developed. In *Thailand* IWT is next to road in share of freight carried (about 20 million tons). Passenger movement in and around Bangkok is significant, with different types of services, including express services. In *North America* freight movements on the Great Lakes and

the Mississippi continue to be important modes. Leisure activities based on water movement are common. The Transportation Research Board publishes studies on a variety of aspects of IWT in North America and elsewhere. In *Europe* IWT is estimated to carry about 7% (and growing) freight traffic in member-states of the European Union. In EU states with waterways, this proportion is 12% overall and it accounts for more than 40% of ton-km in some regions (European Commission 2001). River training and use of rivers and canals for a variety of purposes has been common for a number of years. IWT is seen as a complementary mode of transport and offers an alternative for environmental concerns. The current challenges are safety and the development of information systems to harmonize IWT traffic across Europe. In *China*, navigable inland waterways total more than 100,000 km and there are a large number of inland port facilities with berths for large vessels. IWT accounts for almost 10% of the freight tonnage, two-thirds of it being carried on the Yangtze (including coal, steel, cement, containers, and LPG). Many steel mills, located along the Yangtze, use barges. Downstream Yangtze carries barges up to 10,000 tons capacity. Barges move on the river for more than 3000 km. A shift in priorities is reflected in the construction of the Three Gorges Dam, a 590-km-long reservoir, which will involve locks for barges to traverse. Navigability of the river upstream and downstream may actually improve with the controlled flow of water.

Environmental Impact

The increased drawing of water for drinking, irrigation, construction, and other activity reduces the overall flow of water in downstream regions and makes transport operations difficult. Dams also hamper smooth transport. But where IWT is physically possible and commercially viable as part of a supply chain for a shipper, it is usually the most appealing environmentally, with its low fuel consumption and ability to carry in bulk, thereby reducing handling-related pollution and congestion.

Policy Issues in India

National

The proportion of traffic carried by IWT is a fraction of that carried by road and rail. Experience elsewhere suggests that strategic investments

in some modes of transport can impact shares of movement significantly, with a resulting impact on competitiveness. The general principle of government investment is that it concerns those facilities and operations which go outside a normal commercial domain. Large investments with long-term impact and which are likely to be used by numerous commercial entities are candidates for government participation. River training, including dredging, mapping of the river, and providing navigational support are some tasks in this domain.

Tasks such as terminal construction and operation are viable for private participation. Experience in Goa indicates that the private sector has the capability and will to invest in barge ownership, operation, and supporting services such as barge building, maintenance, and repair. A significant facilitator is the terminal facility for handling iron ore at Mormugao Port. Emerging private participation in port activities is an interesting possibility. At Mormugao there is already private operation of some berths and coal handling and dry dock repair operations.

Exhibit 1 summarizes the various facets of inland waterway activities and participation and a representative existing mix of actors in this sector. The role of regulation and waterway provisioning is currently only with IWAI and limited to the National Waterways.

International

In the international domain the main issue is the protocol with Bangladesh, for two reasons. First, export traffic to Bangladesh and a small amount of import from Bangladesh is a component of trade on both NW-1 and -2. River movement is especially viable as there are a number of inland and river ports in Bangladesh which are oriented to cargo handling. Secondly, domestic movements on NW-2 between the Assam region and Haldia/Kolkata areas pass through a significant stretch in Bangladesh and are subject to the protocol. While the protocol permits vessels of either country to carry Indo–Bangladesh trade cargo and prohibits one country's vessels carrying intra-country traffic of the other, Bangladesh vessels are permitted to carry Indian domestic cargo transiting Bangladesh. Further, Bangladesh vessels carrying their domestic cargo have a short empty lead to reach Haldia/Kolkata for picking up import cargo (which is significantly higher), while the same economics would not apply for Indian vessels. Consequently, Bangladesh vessels are able to offer more competitive rates than Indian vessels.

Exhibit 1

		Government Agencies	*Public Sector Enterprises*	*Private Sector Enterprises*
	Regulator →	IWAI*	–	–
Waterway	Construction of waterway	IWAI*	CIWTC in Sunderbans	–
	Maintenance of waterways	IWAI*	Subcontracted dredging	Subcontracted dredging
	Navigational support	IWAI*	Ports, near port areas (KPT, Port of Panaji)	GPS suppliers
Carriers (vessels)	Vessel manufacturing	–	CIWTC, Hooghly Docks, GRSE	Several
	Vessel ownership	IWAI*	CIWTC/KSINCL** and others	Several, including mine owners
	Vessel maintenance/repair	–	CIWTC/KSINCL and others	Several
	Vessel operation	–	CIWTC/KSINCL	Several
Terminals (Jetties)	Terminal construction	IWAI*, state governments	Mormugao Port Trust, CIWTC	Several
	Terminal operation	–	Mormugao Port Trust, CIWTC	Several

* IWAI for National Waterways only.

** Kerala State Inland Navigation Company Limited.

Source: Authors' analysis.

Policy Recommendations and Conclusions

The potential of IWT is sufficient to justify a national body such as the IWAI with a sharp role in nurturing the sector, but its sustenance needs to be judged contextually for each waterway or waterway system.

Should Government Invest in IWT?

Given a sector turnover of about Rs 110 crore annually, the sector investment of Rs 308 crore (Rs 1701 crore proposed) in the Ninth Plan, and in the Tenth Plan of Rs 5665 crore (proposed) does not make commercial or economic sense. Existence of a driving cargo stream of sufficient volume is required to justify large investments. Natural draft of at least 2 m should be available for operations of craft of viable size.

Passenger movements are possible at low cost, but would need faster vessels and good interchange facilities. Launches carrying road vehicles may be a viable and cost-effective proposition in some parts of the country.

Tourism and related activities offer good potential with appropriate local investments and operational control, wherever relevant.

Technical capability and vessel supply are available in the country and a unified and liberalized policy with regard to IWT and coastal shipping will benefit the sector.

Government should invest in a measured manner, given the considerations of a possible primary driving cargo and specific geographic potential. A tie-up with the industrial location policy to drive demand would be essential.

Where Should Government Invest?

- NW-1: Investment based on integrated water use for irrigation, drinking and industry, and for controlled flow
- NW-2: Investment due to strategic importance as an alternate route for bulk movements
- NW-3: Tourism-related investment
- New canal systems (e.g. Narmada canal)
- River linking projects, if pursued by government, should explicitly provide for IWT.

Freight carriage by IWT has succeeded where an interface exists with ports and the larger marine supply chain. A further opportunity exists if

there are vessels capable of inland as well as coastal operations or there is a good interface between these two sectors. Tidal river systems are especially attractive because their draft availability is generally good and there is no competing demand for their saline water.

Possible driving cargo for the future is:

- Bulk for export or import through ports (Mormugao, Kochi, Haldia, Kolkata)
- Coal to Bangladesh
- Coal to and fly-ash from thermal power plants
- Construction material for the North East (dams and other large projects)
- Agricultural exports.

Government Policy Instruments

- Industrial location policy has played a big influence on the demand for cargo and can play a big role in providing the driving cargo.
- Adjustable subsidies on movements by IWT would be a better way to build traffic than enforcing percentages of movement by a particular mode.
- The protocol with Bangladesh on use of Bangladesh waters by Indian vessels and vice versa and the commercial conditions of operation need to be uniform and liberalized.

Governmental Institutions

- IWAI needs to be accountable for the provision of draft on the National Waterways. Certification (perhaps by NINI or an independent body) of this may be necessary.
- IWAI needs to initiate a revenue model based on a combination of usage fees, cess (on other transport modes to finance this mode, if environmentally desirable), and explicit subsidy needs. The local revenue model in Goa offers an example.
- Traffic potential needs to be professionally assessed for origin-destination flows, commodity flows and values, and revenue potential.
- In policy formulation and implementation, the following stake-holders should also be taken along: barge operators, shippers (e.g. mine owners), Bangladesh operators, and state governments.

References

CIWTC (2004a), *Internal Notes*.

CIWTC (2004b), *Fixed Schedule Sailing National Waterway 1; A Report*, Central Inland Water Transport Corporation, Kolkata.

CMYK (2005), *Darpan*, February. CMYK Multimedia, New Delhi.

European Commission (2001), *White Paper—European Transport Policy for 2010: Time to Decide,* Directorate General for Energy and Transport, http://www.europa.eu.int/comm/dgs/energy_transport, Luxembourg.

GMOEA (2004), *Goan Mineral Ore Exports,* Goa Mineral Ore Exporters' Association, Goa.

Indian Infrastructure Publishing (2004), *Indian Infrastructure*, 6(7), February, New Delhi.

Outlook Publishing (2004), *Outlook Traveller,* November, Mumbai.

Planning Commission (2001), *Report of the Working Group on Inland Water Transport*, 9/2001, New Delhi.

Raghuram, G. (2004), *Integrating Coastal Shipping with National Transport Network in India*, *Proceedings of the International Association of Maritime Economists, Annual Conference 2004, vol. II*, School of Maritime Business and Management, Dokuz Eylul Publications, Izmir.

Rahman, Mushfequr (1994), 'National Transport System of Bangladesh', *Asian Transport Journal*, November, Asian Institute of Transport Development, New Delhi.

Rangaraj, N. and G. Raghuram (2005a), *Inland Water Transport,* Research paper commissioned by the Asian Development Bank and the Department of Economic Affairs, Indian Institute of Management, Ahmedabad and Indian Institute of Technology, Bombay.

Rangaraj, N. and G. Raghuram (2005b), *Systems Perspectives on Inland Water Transport for Freight Movement*, presented at the 37th annual meeting of the Operational Research Society of India, Ahmedabad, January 8–11.

SRFDCL (1998), *Sabarmati Riverfront Development*, Sabarmati Riverfront Development Corporation, Ahmedabad, May.

TRW (2001), *Statistics of Inland Water Transport 1999-2000*, Transport Research Wing, Ministry of Shipping, Government of India, New Delhi.

TRW (2002), *Statistics of Inland Water Transport 2000-01*, Transport Research Wing, Ministry of Shipping, Government of India, New Delhi.

WB (2005), *China Inland Waterways Project*, The World Bank, http://www.worldbank.org/transport/ports/iwt_dev.htm

www.travelchinaguide.com, http://www.travelchinaguide.com/faq/cruise/three-gorges-project.htm

Asian Development Bank
India Resident Mission
4 San Martin Marg
Chanakyapuri
New Delhi 110021