Viability of Inland Water Transport (IWT) in India

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1. Introduction

Water based transport is effective as generally speaking, operating costs of fuel are low and environmental pollution is lower than for corresponding volumes of movement by road, rail or air. A major advantage is that the main infrastructure – the waterway – is often naturally available, which then has to be "trained", maintained and upgraded. Transport over waterways is especially effective when the source and/or destination are waterfront locations.

This paper attempts to assess the viability of movement of passengers and freight by inland water transport (IWT) in India. The methodology of the study is given in Appendix 1. Inland waterways refer to rivers, canals, lakes etc., but there is an overlap of this sector with coastal shipping where tidal rivers are involved. Legally, there are separate Acts covering inland waterways, the vessels that can ply on them [MOLJ, 1986] and the setting up of the Inland Waterways Authority of India (IWAI) [MOLJCA, 1985]. Three waterways in the country have been designated as National Waterways (NW-1, NW-2 and NW-3) and their jurisdiction is given in Appendix 2. A brief survey of each appears in Appendices 3, 4 and 5.

1.1 Policy motivation

The sector has received large funding in both the ninth and tenth plans. The sector has not been able to effectively utilize the funds allocated to it over the last few years [Planning Commission, 2001]. However, it continues to be a significant focus area for investments, for example, a Rs 300 crore investment planned by ADB [Indian Infrastructure, 2004]. IWT is an important component of the National Maritime Development Project (NMDP) as part of the overall maritime policy of the country. In this context, the main policy questions can be posed as follows.

Should the government invest in IWT? To what extent and where?

What is the role of the major institutions in this area (the most important one being IWAI)?

What are the policy instruments available to the government to regulate and support the sector at an "appropriate" level?

Who are the major stakeholders in this sector and how does policy in this area take into account their concerns?

1.2 Scope of the research

The potential for this mode of transport has been unquestioned over the years and it forms a significant fraction of ton-km of movement in countries across the world. In Germany IWT constitute 20% [WB, 2005] and in Bangladesh it is 32% [Rahman Mushfequr, 1994]. However, in India, it has become a very marginal part (0.15%) [Raghuram G, 2004] of the

overall transport movement, both in absolute terms and in terms of share vis-à-vis other modes. One of the objectives of this research is to understand the reasons for this. Also, while investments in this sector have not equaled those in rail in early years and road in more recent times, there are proposals for investing in this sector. This research will try to eventually offer an opinion on the commercial viability of such investments by the government or other players.

1.3 IWT in India

Historically, at least on some geographical sectors, it has been a viable mode of freight transport. Currently, three major waterways in the country have been designated as National Waterways: NW-1, the Ganga-Bhagirathi-Hooghly system, from Allahabad to Haldia, NW-2, the Brahmaputra system in Assam and NW-3, the West Coast canal system in Kerala (Appendix 1). Commercially, the most important sector is the small tidal riverine system in Goa, comprising the Zuari and Mandovi rivers and the Cumbarjua canal. A number of possibilities do exist, in terms of in-principle navigable waterways, but the ones that offer some potential (a mix of feasibility and some traffic possibilities) are the riverine inlets along the coast, especially the ones near ports and some of the canal systems as part of larger water resource development projects (Appendix 6). A further possibility can conceivably open up if and when the river interlinking project in the country is found viable. This last possibility is doubtful, at the moment.

Numerous studies (some of which have been listed in the references) have argued that inland waterways are per se a desirable and environmentally friendly mode of transport. In this research, after a brief look at passenger movements, the bulk of the report discusses freight movements on inland waterways.

2. Passenger movement

In India, the main passenger movements by inland waterways that are viable are ferry operations across rivers (at numerous locations on all waterways), on short stretches along rivers and tourism based passenger traffic (in Goa, Kerala, Sunderbans and Northern regions).

Details of such movement are given in 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. Some factors that affect passenger movement are discussed below.

Travel time vis-a-vis the alternate land based route: While time by land routes is generally reducing, with more and more bridges being constructed, it is still sometimes quite viable and direct to have ferry based services in many parts. Faster ferries and launches are a possibility to encourage traffic on this node.

Cost: For passengers, the typical costs of ferry, while not high, have to be added to the costs of the subsequent mode of transport which may have to be used to achieve the end to end requirement of transport.

Interchange convenience: The waterway movement should be able to move seamlessly to other modes, eg bus and train.

A few studies have shown quite convincingly that inland waterways can have a major role to play in the integrated passenger transport planning in an urban area. For example, a study in the Cochin metro area suggests that IWT will be an option that is impossible to ignore in the future growth of the city and calls for integrated investments to increase complementarity with other modes, faster vessels, unified pricing, ticketing and targeted subsidies in the area.

Mumbai has experimented with faster modes of water transport such as hovercrafts (apart from continuing ferry systems), but a sustainable service mix has not been found, as of now.

Inland waterways provide a convenient function in related activities. Some of them are given below.

Carriage of vehicles (preferably in the roll-on-roll-off mode): West Bengal, Kerala and Goa have significant number of these ferry services, but there is potential for much more, with faster boats, proper landing facilities and interchange with other modes.

Tourism, including stay and entertainment: This is a growing activity with economic potential. In Kerala, Alappuzha and to a smaller extent, Kozhikode are centres of this activity, especially for houseboats. Boats that provide music and dining are becoming increasingly common in Mumbai, Goa and Kochi. Long distance river cruises, both as per schedule and as per a group demand are also available, though they retain an exclusive flavour [Outlook Publishing, 2004].

Water sports: This is a new sector that has some possibilities in the rivers in North and East India. White water rafting and trekking on iced mountainous stretches of river are examples [CMYK, 2005].

3. Cargo movement

Historically, location of industrial activity has been influenced by logistical convenience of riverine transport possibilities, at a time when road and rail networks were not so well developed. This may not be true to the same extent today, although access to water for processing and in some cases effluent treatment is still a consideration in location.

The viability of goods movement using IWT is to be analyzed from the perspectives of technological and physical viability, commercial potential and operating policy of carriers and associated agencies. As in any mode of transport, some factors that affect the economics and operation of a transport are the availability of the channel or right-of-way, facilities at the ends of travel and the carriers or vessels, together with all the managerial and supporting infrastructural systems to manage the flows. In IWT, these translate to the availability of the waterway, terminal facilities like jetties and ports, barges and other vessels capable of navigation, and finally the management component.

In India, inland water transport on the Ganga may have provided among the earliest organized transport movements over significant distances, well before rail and road networks developed. Although the issue is not examined in detail here, movement and exports of

commodities like tea, jute, spices in the eastern sector, connected to the riverine port in Kolkata have been among the early commercial drivers of the pre-independence sub-continent.

It is clear from aggregate statistics that the sector has been growing only very slowly in the National Waterways and other major waterways. The glaring exception is the tidal river-canal system in Goa, which saw unprecedented growth and where some 30 million tons of iron ore moved by barges on the Mandovi-Zuari-Cumbarjua system in 2003-04 [GMOEA, 2004]. This solitary example is enough to demonstrate the economic potential per se and may provide some learning points in a variety of dimensions. This is explored in Appendix 6.

In the rest of the document, we examine the technological and physical viability, followed by the traffic potential (including a consideration of other competing modes), and finally the economics of IWT. The management of the sector at the policy level is also addressed.

4. Technological and physical viability

Water flow: The basic prerequisite for water based transport is the availability of water flow. In the main waterways, this may have decreased over the years because of increased usage arising from habitation, industrial and agricultural needs. The extent of regular flow may also have decreased because of the impact of dams on river streams.

River training, dredging and navigation: The next requirement is that the river is trained and consistently provides a sufficient depth vis-à-vis the draft of the vessels that are expected to ply on it. This is possible for some types of river beds and may require maintenance of banks and dredging of the river bed periodically, to maintain the required depth. Recent cost estimates of river training on Sabarmati river provide a figure of about Rs 10 to 11 crores/km [SRFDCL, 1998] on each bank. In rural areas, the figure could be lower, say Rs 8 to 9 crores/km.

In India, IWAI, in principle, commits to maintaining a year-round draft of 2 m along the National Waterways [Planning Commission, 2001]. This is not found to be the case, in practice. One possibility is that it is strategically justified to provide this draft on appropriate channels, by an assessment of the commercial traffic potential on each waterway. The other option is for operators to plan for a realistic draft of 1.5 m and see if that is operationally viable.

The requirements for navigation are channel markings, night navigational aids, including the possible deployment of GPS and river maps and charts for navigation. The National Inland Navigation Institute in Patna has been set up to oversee this development by the use of appropriate technology.

Locks: The physical drop of the river channel cannot be too much, or else locks have to be provided to manage the height differential. For example, 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: India has a long history of river based water transport. Among operators, the government owned CIWTC (Central Inland Water Transport Corporation) is the largest owner of vessels and barges. Private operators have a substantial fleet, but have not been investing in new vessels in the last decade. In fact, there has been scrapping vessels of late, and all operators may require some help in reviving them and investing in new vessels. The role of the (government owned) shipyards here is important, including the CIWTC owned and operated Rajabagan Dock Yard in Kolkata. CIWTC can provide repair facilities for other operators in the area as well.

There is a well established industry of manufacture, maintenance and repair of barges in Goa, some of which are operated by mining companies which use barges for transport of ore, and some other organizations. IWT is a sustained economic activity in Goa, and there are many support services available in the state.

5. Commercial potential

From a supply chain perspective, the main reason for using inland waterways as a mode of transport is the fact that it decreases the total cost, when used as part of the end to end logistical requirement of cargo movement.

Geographical advantage of water bridging: This is strongest when the movement is across the river, but can be present in some other movements. Examples of these are passenger ferry services across rivers and transport in the Sundarbans areas in India and Bangladesh.

River based origins/destinations: The next level of advantage is when there is either an origin or a destination, or both, at a river location. This can be classified as follows.

***Project based requirements of commodities*:** This demand is for material relating to a particular project activity. It consists of construction material and transport of equipment related to the project. Where the project is river based (e.g. river bridges, hydro-electric plants), it is most attractive, as the destination is the water site itself. Even otherwise, it may be viable in some cases.

***Large customers with regular demands*:**

Existing traffic: By far the biggest example here is the iron ore export requirement from mines in north and south Goa, which access the Mandovi and Zuari rivers. This movement is expected to continue, along with movement of ore from Karnataka, after blending, for the next five to seven years at least. Appendix 6 has some details on inland waterways in Goa. FACT in Kerala has been a steady customer for most of its input raw materials (Appendix 5).

Potential traffic:
Oil refineries in the north east: Numaligarh, Dibrugarh and Digboi.
Oil refineries elsewhere on river bank locations such as Haldia and Barauni.
Thermal power plants, for bringing in coal and carrying away fly-ash at locations like Barh and Bandel.

While many industries are located near water sources for convenience of water use, the potential of using water for transport does not seem to be there. For example, the thermal

power plants in Ahmedabad, Bhusaval and other river locations. A major constraint in this is the non-availability of year long draft.

Small customers with regular demand: This is based on agriculture or manufacture of commodities and meant for consumption/processing within the country, or for export. This segment is slowly increasing, from the estimates of CIWTC [CIWTC, 2004a] and other barge operators in NW-1.

Small customers with occasional demand: These could be occasional users of IWT, but could sometimes be high value movements, such as movement of machinery and equipment on river based projects. This has proved to be a viable activity for bridge building.

Export/import traffic through ports: Exports and imports through ocean-going liners are a good candidate for IWT where possible, because of the economic value and impact.

Existing traffic: As discussed above, iron ore from Mormugao and Panaji ports is fed entirely by barge traffic through the Zuari and Mandovi river system in Goa. This is explored further in Appendix 6. FACT imports raw material for its fertilizer plants in Kerala (Appendix 5).

Potential traffic: Some traffic through Haldia port is viable from a supply chain principle because the riverine system is connected to the port operation and barges can unload directly on to ocean going vessels, provided customs formalities can be carried out without entering the port. The cost savings are likely to be significant.

Volumes of flow (ton and ton-km): Aggregate assessments of traffic are available in statistical studies of the Ministry of Shipping and the IWAI, as well as the studies made on Inland Waterways as part of the Plan documents for the 10th Five Year plan. Disaggregate assessments about potential traffic on NW-1 and 2 are available from CIWTC and other operator records and also in the data provided region-wise in the IWAI supported studies on the development of the Kolkata Port Trust region.

Value of flow and revenue potential: CIWTC operates under a rate schedule proposed by IWAI. Given the service requirements (see below), the main consideration is the volume occupancy of the material and whether the vessel can carry the required volume. The revenue potential is also subject to the charges for loading and unloading, which has to be borne by the user.

The revenue potential in the existing iron-ore export supply chain in Goa is explained in Appendix 6. The movement for FACT in Kerala is marginally competitive.

Service requirements: The basic requirement of freight demand is physical handling from door to door. In the case of IWT, this involves movement to and from the water mode, including the loading and unloading of material on to and from the vessel and proper storage of the material on docks and in the vessel.

IWT is generally slow in movement, compared to other modes, so very expensive cargo does not move by this mode, unless there are physical constraints to moving by other modes. IWT is a comparatively secure mode of movement.

Competing modes: For IWT, the competing modes of transport are rail and road, and combinations of these (sometimes with IWT itself). Broadly speaking 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. IWT offers medium batch size possibilities, slow movement, limited door-to-door opportunities and cheap rates.

There are examples such as Kerala, where traffic has shifted from IWT to other modes in recent times in the last one decade (Appendix 5).

6. Operational viability

Costs: IWT is a capital intensive industry, even for operators, as significant investment is required in vessels, for a start. Investments required to provide and maintain the waterway and terminals are of an even higher scale and come under the heading of infrastructure. In today's environment, it is only IWAI which can maintain the waterway and a few large customers (e.g. project based shippers and bulk manufacturers like refineries and steel plants) who can participate in investments for terminals.

Operating costs can be categorized as below.

- Vehicle costs
- Fuel costs
- Crew costs
- Maintenance costs
- Loading Unloading costs

Besides these, there are costs to do with contingencies like running aground and damage to vessels. These are not rare, under current operating conditions of insufficient draft, even in the National Waterways.

An example of costing is provided in the Goa operations in Appendix 6.

Systems perspectives: A detailed study emphasizing the systems perspective in analyzing the IWT mode is presented in a companion research paper by the authors [Raghuram and Rangaraj, 2005]. This study draws on illustrative examples from the Goa scenario and typical freight operations over multiple destinations in NW-1 and highlights the principles of supply chain management and the possible use of network flow models and scheduling models for analysis. Also proposed is a model for identifying the range of viable operation from the point of view of (a) the competitive fare provided by other modes, (b) the size of barge and therefore the operating cost (c) the desired throughput and (d) the total cost to the customer (and therefore a price that can be charged).

Fleet planning: Barge operations rely on economies of scale in movement, as fixed costs of the vessel (barge) and crew are quite high. The trade offs here are as follows: Larger barges have more draft and require a larger water depth, but have lower operating costs. For customers, the lower freight costs are offset by higher inventory staging costs. The barge size is also limited by the throughput consideration, as large barges may have operating restrictions and small barges may cause too much congestion in handling the required traffic.

This leads to an operating range of sizes and related costs that are incurred and therefore the prices offered to customers.

Scheduling: Two types of schedules are possible in transport operations. Fixed schedule movements (which provide for more certainty for customers, makes vehicle deployment easy and where operational costs are more controlled) and variable schedules (which provide for more responsiveness and can reduce unremunerative runs). CIWTC operates both types of services [CIWTC, 2004]. In NW-1 and 2, it is the only operator that has a large enough fleet to be able to attempt fixed schedule movements.

Summary of operational viability: From the analysis of operations in NW-1 and the Goa iron ore movements by barge, it becomes clear that barge economics is a capital and scale intensive activity. The preferred barge size in the NW-1 sector seems to be about 750 T, given an optimistic view of the draft that is available (when sufficient draft is not available, the vessel has to be operate below capacity). In Goa, the preferred size is now about 1500 T and 2000 T barges are also operated. This is viable, given the volumes of cargo and also the efficient loading and unloading practices, which allow for good barge utilization. In NW-1, one may have to consider smaller barge sizes with more valuable commodities. Here, since the servicing requirements are likely to be higher than what IWT can offer, a big market is doubtful initially. Agri-export is one possibility and the other is project related activity, both of which have some volume potential.

7. Other issues

7.1 Role of agencies

In India, a number of central and state agencies play a role in the regulation, operation and sustenance of inland water transport. Their smooth functioning is required for IWT to be viable. This is a complex issue and needs to be addressed in the remaining part of this research. Some of the actors in this sector are given below.

- IWAI
- CIWTC and other operators
- Customers
- State governments
- Port authorities
- Transport development agencies

The regulatory-cum-infrastructure provider role that IWAI is supposed to take needs to be sharpened keeping in mind the operational aspects of this sector. IWAI has taken on a limited role in provision of some infrastructure at terminals (for example at Patna, Guwahati and Kerala) and has also commissioned some medium size barges for operation. But the main responsibility of IWAI remains the provision an effective waterway at least on the National Waterway system.

The system of recovering reasonable operational charges for various services and thereby ensuring a level of service on the infrastructure has not yet evolved in inland waterways. In India, the other two major modes of transport (road and rail) have very different operating and regulatory models and a suitable model needs to be evolved for IWT.

Inland water operations are often interfaced with coastal and deep sea movements. While ocean movements are guided by a mix of international and national laws, coastal shipping is within the ambit of the central government control and an attempt can be made to synergise this activity with IWT where possible. The major issues are those of operating standards, including vessel certification, safety and personnel related concerns.

CIWTC, based in Kolkata is an organization that has been loss making and which has been considered for privatization. It has a large fleet of barges, but not many that are in operation (for both traffic reasons and operability). A complementary asset is Rajabagan Dock Yard, which does have facilities for ship-building and repair of the required range of vessels. Although the Dock Yard has also shown some improvement, neither it nor the River Services Division is close to being financially and operationally viable as of now. Given the declining demand and the large overheads of CIWTC, its continued presence is not critical for IWT. The various services provided by CIWTC would however retain their significance. This includes ship-building and repair, terminal operations, barge operations and warehousing.

The National Inland Navigation Institute is functioning in India. It has limited staff strength and has so far done training and certification and a few focused studies.

7.2 Other country experiences

Surveys have been done in past reports, of other countries where inland waterways have been successfully used and continue to be used. In the region, UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific) publications 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 standardisation 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.

IWT experience across the world is varied and offers interesting comparisons. What follows is an indicative set of observations.

Bangladesh: A significant fraction (about 35%) of the freight movement in the country is by IWT because of the geography of the region. Riverine ports are quite well developed and competing modes (rail and road) are not as developed in comparative terms.

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.

North America: Freight movements on the Great Lakes and the Mississippi continue to be important modes. Leisure activities based on water movement are quite common. The Transportation Research Board publishes studies on a variety of aspects of IWT in North America and elsewhere.

Europe: IWT is estimated to carry about 7 per cent (and growing) of freight traffic in those EU states. In the 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 another option as part of the environmental impacts of different modes of transport and the increasing role of multi-modal transport and containerization. The current challenges are safety and the development of information systems to harmonize IWT traffic across Europe.

China: The navigable inland waterways in China total more than 100,000 kilometers and there are a large number of inland port facilities with berths for large vessels. IWT accounts for almost 10 per cent of the total freight tonnage carried in the country, and of that, two thirds is carried on the Yangtze river (including commodities like coal, steel, cement, containers and LPG). In particular, many steel mills are located along the Yangtze river and use barges for transport of material. The downstream part of the river carries barges up to 10000 T capacity. Barges move on the river for more than 3000 km, but a shift in priorities is reflected in the construction of the Three Gorges Dam, which is a 370 mile long reservoir and which will now involve a system of locks which barges will have to traverse. The full impact of this on river traffic is not yet clear. In fact, navigability of the river upstream and downstream may actually improve with the controlled flow of water that the dam provides.

7.3 Environmental impact

Water is per se a scarce resource in the country. The use of water for facilitating transport may be sometimes difficult to justify. Related to this is the increased drawing of water for drinking, irrigation, construction and other activity, which reduces the overall flow of water in downstream regions. This makes transport operations difficult. Dams provide another level differential barrier to smooth transport. Given all these constraints, inland water transport is not at all the automatic first choice for movement of goods – a position that it enjoyed for many centuries in the past.

However, where it is physically possible and commercially viable as part of a supply chain for a shipper, it is usually the most appealing environmentally. The basic reason for this is low fuel usage and therefore low pollution from emissions, and ability to carry in bulk, thereby reducing handling related pollution and congestion.

8. Policy issues in India

8.1 National

The key issues here are investments in national waterways and associated infrastructure. The proportion of traffic carried by IWT is very small. One of the reasons is the development of road and rail traffic, which have become very viable modes of transport. But a case can also be made that investment in the IWT sector has been small, compared to the other two. Worldwide experience suggests that strategic investments in some modes of transport can impact shares of movement significantly and with the resulting impact on overall costs and competitiveness. In this context, IWT can be examined, at least for selective enhancement of the sector.

The general principle of investment by the government in such sectors 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 where appropriate. The operations in Goa indicate 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 in the future. At Mormugao also, there is private operation of some berths and coal handling and dry dock repair operations already.

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.

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
Source: Authors' analysis

8.2 International

The main issue is the protocol with Bangladesh. This is important for the following reasons.

- Export traffic to Bangladesh and a small amount of import from Bangladesh is a component of trade on both NW-1 and NW-2. River movement is especially viable as there are a number of inland and riverine ports in Bangladesh which are oriented to cargo handling.

- Domestic movements on NW-2 from/to the Assam region to/from 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, the Bangladesh vessels are permitted to carry Indian domestic cargo passing via Bangladesh. Further, Bangladesh vessels carrying their domestic cargo have a short empty lead to come to 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.

9. Conclusions

Freight and passenger movement by water is an attractive proposition prima facie, being one of the earliest modes of freight transport used world-over. The potential is sufficient to justify a national body such as the IWAI with a sharp role in nurturing the sector. But its sustenance in today's economic context in India needs to be judged contextually in the case of each waterway or waterway system.

The conclusions of our study are divided into five broad areas below.

9.1 Prima facie viability: Should Government invest in IWT?

Given a sector turnover of about Rs 110 crores annually, the sector investment by the government in the 9th plan: Rs 308 crores (Rs 1701 crores, proposed) and in the 10th plan: (Rs 5665 crores, proposed) does not appear to commercially or economically viable, even with projections of the growth of traffic, barring in a few sectors.

Existence of a driving cargo stream of sufficient volume is required to justify large investments where natural depth of water and navigability are not adequate, per se. 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 than area currently available. 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 is available in the country and a unified and liberalized policy with regard to IWT and coastal shipping will benefit the sector.

Finally to answer the question, we say that 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.

9.2 Where should Government invest?

Possibilities are outlined for each waterway and port interface.

- 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 (eg Narmada canal)
- River linking projects, if pursued by Government, should explicitly provide for IWT

The locations where IWT for freight is successful in India are because of the interface 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 vessels on these two sectors.

Tidal river systems are especially attractive in this context also because their draft availability is generally good and also there is no competing demand for the saline water in these systems for use in drinking, irrigation or construction.

Possible driving cargo for the future are:

- Bulk for export or import through ports (Mormugao, Cochin, 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)
- Agri exports

9.3 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, rather than enforcing percentages of movements by a particular mode.

The protocol with Bangladesh on usage of Bangladesh waters by Indian vessels and vice versa and the commercial conditions of operation need to be uniform and liberalized.

9.4 Governmental policy: 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 to be in place. The local revenue model in Goa offers one way of doing this.

Traffic potential needs to be professionally assessed with a competitive perspective in the following dimensions: Origin-Destination flows; Commodity-wise flows and values, and Revenue potential.

9.5 Key stakeholders

Apart from the planning commission, central ministries and institutions like the IWAI, the following stakeholders should also be taken along for policy formulation and implementation

- Barge operators
- Shippers (eg mine owners)
- Bangladesh operators
- State Governments.

References

1. CIWTC, 2004a. *Internal Notes*.
2. CIWTC, 2004b. *Fixed Schedule Sailing National Waterway 1; A Report*, Central Inland Water Transport Corporation Ltd., Kolkata.
3. CMYK, 2005. *Darpan*, February, 2005. CMYK Multimedia Pvt Ltd, New Delhi.
4. European Commission, 2001. *White Paper-European Ttransport Policy for 2010: Time to Decide*, Directorate General for Energy and Transport (http://www.europa.eu.int/comm/dgs/energy_transport), Luxembourg, 2002.
5. GMOEA, 2004. *Goan Mineral Ore Exports*, Goa Mineral Ore Exporters' Association, Goa.
6. Indian Infrastructure Publishing, 2004. *Indian Infrastructure, Vol. 6 No. 7*, February 2004, New Delhi.
7. MOS, 2001. *Inland Water Transport Policy*, Ministry of Shipping, Government of India, New Delhi,
8. MOLJ, 1986. *The Inland Vessels Act, 1917*, Ministry of Law and Justice, Government of India, New Delhi
9. MOLJCA, 1985. *Inland Waterways Authority of India Act*, Ministry of Law, Justice and Company Affairs, Government of India, New Delhi.
10. Outlook Publishing, 2004. *Outlook Traveller*, November,2004, Mumbai.
11. Planning Commission, 2001. *Report of the Working Group on Inland Water Transport*, Sr No 9/2001, New Delhi.
12. 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, 2004
13. Raghuram G and Rangaraj, Narayan, 2005. *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, 2005.
14. Rahman Mushfequr, 1994. *National Transport System of Bangladesh*, Asian Transport Journal, Asian Institute of Transport development, New Delhi, November 1994.

15. SRFDCL, 1998. *Sabarmati Riverfront Development*, Sabarmati Riverfront Development Corporation Ltd, Ahmedabad, May 1998.
16. TIFAC, 1992. *Techno Market Survey on Adaptation of Irrigation Canals for Navigation.* Technology Information, Forecasting and Assessment Council, New Delhi, August 1992
17. TRW, 2001. *Statistics of Inland Water Transport 1999-2000*, Transport Research Wing, Ministry of Shipping, Government of India, New Delhi.
18. TRW, 2002. *Statistics of Inland Water Transport 2000-01*, Transport Research Wing, Ministry of Shipping, Government of India, New Delhi.
19. WB, 2005. *China Inland Waterways Project*, World Bank, http://www.worldbank.org/transport/ports/iwt_dev.htm
20. www.travelchinaguide.com, http://www.travelchinaguide.com/faq/cruise/three-gorges-project.htm

Additional references

1. Chowdhary, Vinod, 2003. Rivers of Growth, Spot Light, vol.3, issue II, November 2003.
2. CIWTC, June 2004. Discussion note, 02 June 2004.
3. Government of India, 2003. *Outline of Sagar Mala Project*
4. MOST, 2002. *Inland Waterways Authority of India Rules*, 1986, Ministry of Surface Transport, Government of India, New Delhi.
5. IWAI, 1993. *Delegation of Powers: Amended in 37th Meeting of the Authority held on 26.11.1993*, Inland Waterways Authority of India, Noida.
6. IWT Directorate, July 2003. *Statistical Data on IWT in the State of West Bengal for the Year 2001-2002*, Inland Water Transport Directorate, Transport Department, Govt. of West Bengal, 2nd July 2003.
7. Kraan, Martin, 2002. Inland *Waterway in Europe At What Level We Want to Play*, Seminar On "The Inland Waterways of Tomorrow on the European.
8. MOST, 1986. *Subordinate Legislation under the Inland Vessels Act, 1917*, Ministry of Surface Transport, Government of India, New Delhi.
9. Planning Commission, 1980. *Report of the National Transport Policy Committee*, Government of India, New Delhi.
10. Sriraman S, 1998. *Inland Water Transport in India: Issues and Prospects*, Asian Transport Journal, Asian Institute of Transport Development, New Delhi, June 1998.
11. Tayal, Praful, 2004. *"India – 2010" (Inland Water Transport Sector: IWT)- A Vision*, Central Inland Water Transport corporation Ltd, Kolkata.
12. TIFAC, 1996. *Waterways Technology Vision 2020*, Technology Information, Forecasting and Assessment Council, New Delhi, March 1996
13. WBTD, 2001. *A Study on Passenger Ferry Services on the River Hoogly (Kalyani to Kakdwip)*, Transportation Planning and Traffic Engineering Directorate, Transport Department, Government of West Bengal, July 2001.
14. UNESCAP Transport and Tourism Division, Publications (http://www.unescap.org/ttdw)
15. Statistics of the Directorate of Inland Water Transport, Govt of Assam, 2003-04.
16. Inland Water Transport in North East Region: Water-ways of the North East region, Manuscript prepared by the Directorate of Inland Water Transport, Govt of Assam for the 9th Five-year plan.

Appendix 1: Methodology of the Study

A survey has been made of published literature and statistics on Inland Water Transport in India to understand the historical development, the existing status of the movement, and the investments in the sector. A summary of the major recommendations and actions has been provided in Appendix 9. There is not too much material available on the potential traffic for the sector, on specific corridors. More particularly, the existing studies need to be linked up with the competitive transport environment, where shippers find it economical to transport goods in a particular mode and where carriers are able to meaningfully invest in the infrastructure and services for this purpose and finally, where government and other agencies may have a regulatory or facilitating role.

A selected list of references has been provided.

Visits and interviews have been conducted with various players in the IWT sector. These include:

- Central Inland Water Transport Corporation in Kolkata
- Barge owners and operators in Kolkata
- Shippers of goods in Kolkata, Patna and Munger and agents of Bangladeshi vessels
- Kolkata Port Trust and providers of GPS and other navigational support
- W.Bengal department of inland water transport
- Mormugao Port Trust
- Barge owners in Goa and their association
- Mine exporters in Goa and their association
- Captain of Ports in Panaji
- Railway ore unloading point and barge loading points in Goa.
- Inland Waterways Authority of India in Noida
- Cochin, Alappuzha and other points on NW-3
- Kerala Shipping and Inland Navigation Company Limited
- Kerala State Water Transport Department, Alappuzha
- FACT, Kerala
- Barge owners and tour operators in Kerala

Inter-country comparative studies are available in the literature. Geographically and economically, the Bangladesh riverine transport system is the one that is closest and most meaningful to study and compare, at least for the IWT sector in East and North India.

Appendix 2: The National Waterway System

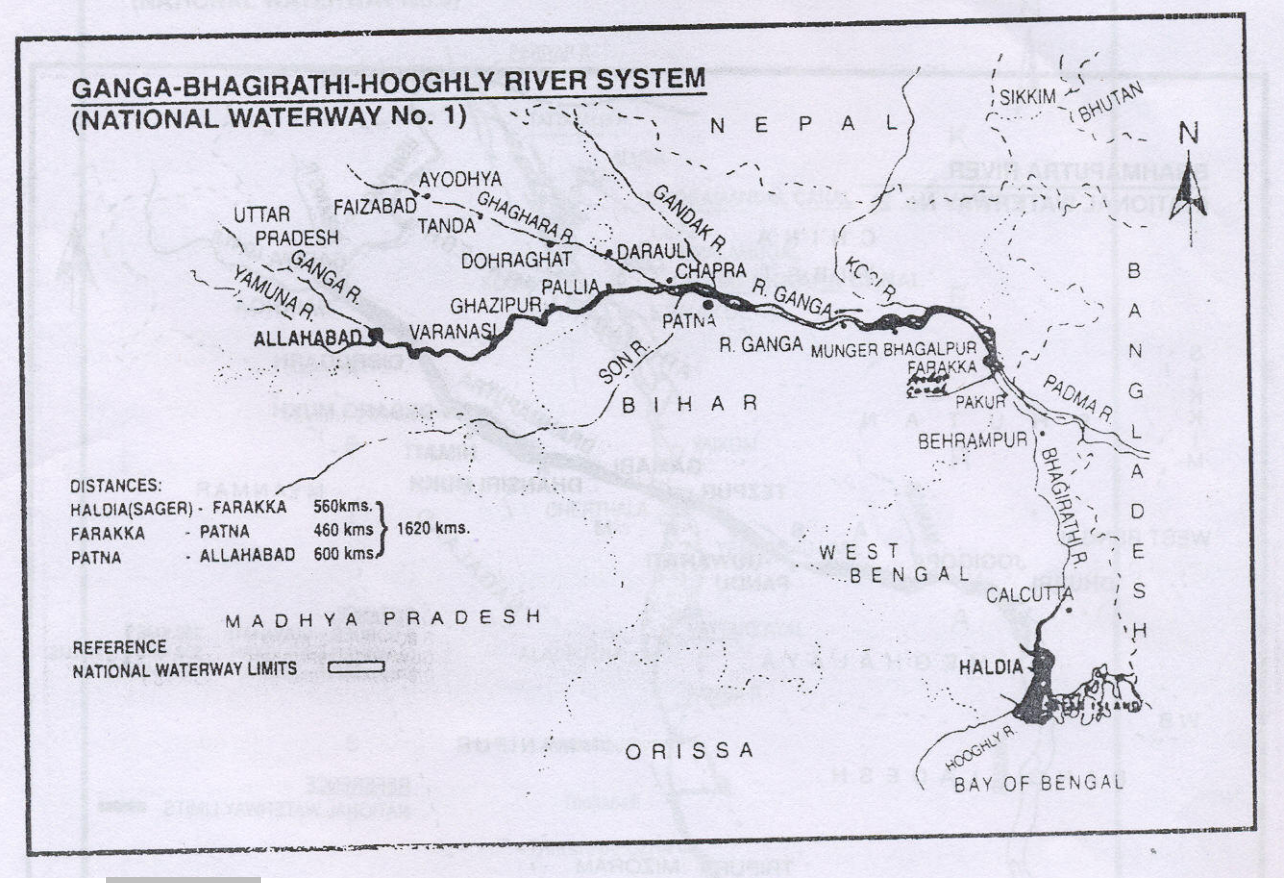
			Cargo Moved		
	Details of National Waterway	**Distance** (kms.)	**1998-99** Lakh Tons	**1999-00** Lakh Tons	**2000-01** (P) Lakh Tons
1	National Waterway 1 (Allahabad -Haldia stretch of Ganga -Bhagirathi-Hooghly river system)	1620	8.52	7.31	3.52
2	National Waterway 2 (Sadiya-Dhubri stretch of Brahmaputra river system)	891	0.09	0.06	0.04
3	National Waterway 3 (Kollam-Kottapuram stretch of West Coast Canal along with Champakara Canal and Udyog-Mandal Canal)	205	10.27	11.12	10.85
	Total	**2716**	**18.88**	**18.49**	**14.41**

(P) : Provisional

Note : Cargo handled in Calcutta –Bangladesh-Calcutta route is taken in National Waterway 1. This route is a link between NW-1 and NW-2 through Bangladesh

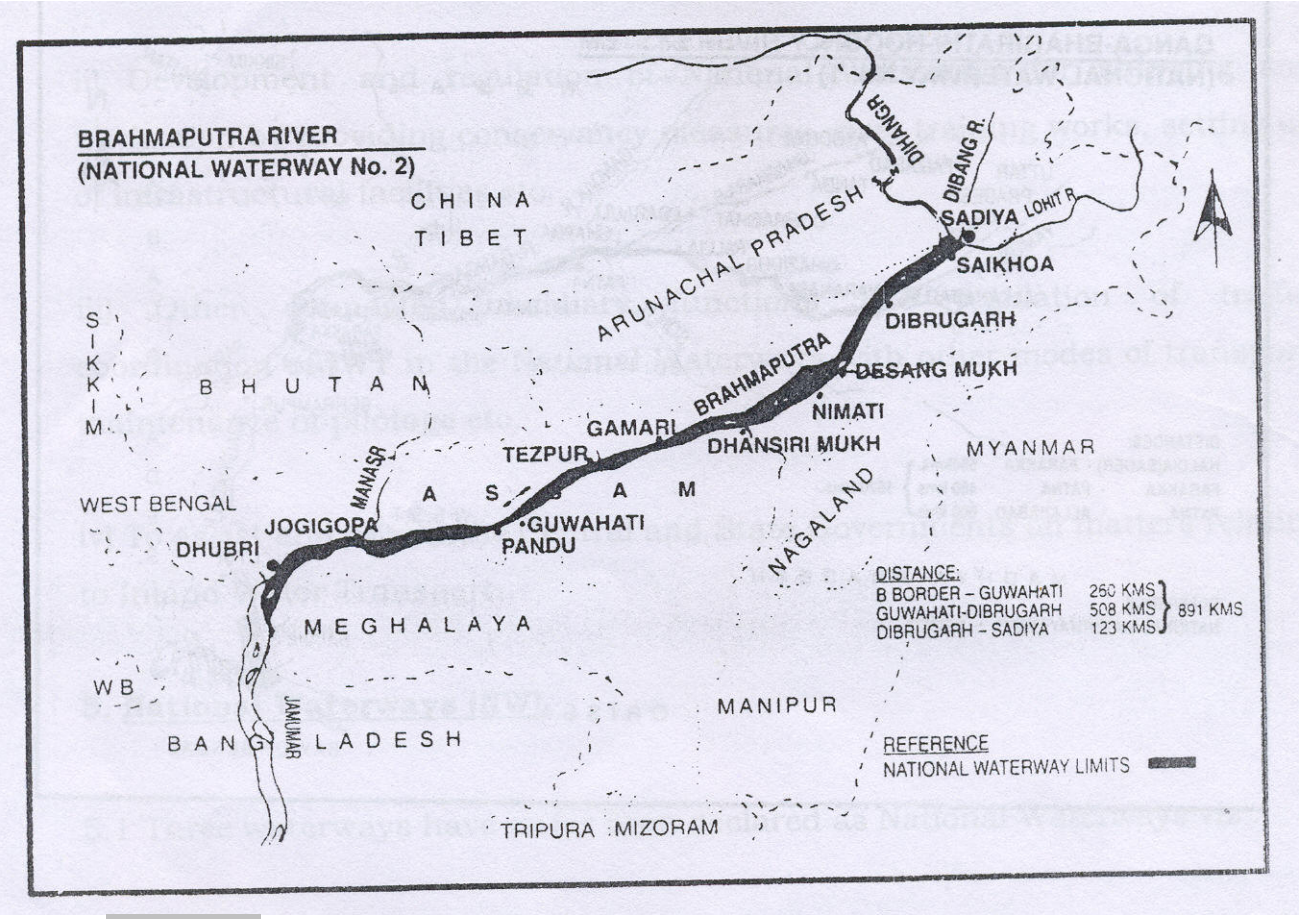
Source : Inland Waterways Authority of India

National Waterway 1



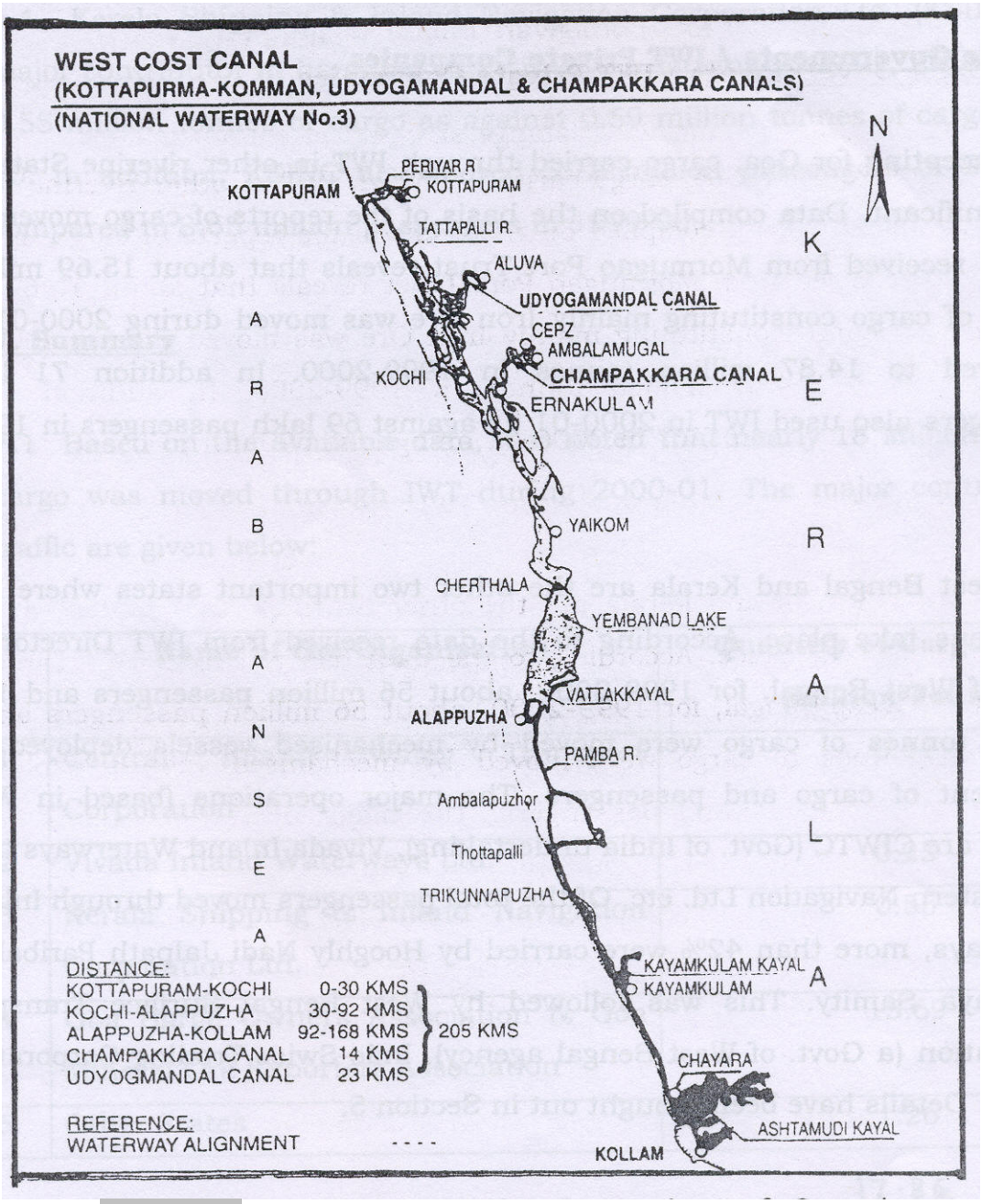
Source: IWAI, 2004

National Waterway 2



Source: IWAI, 2004

National Waterway 3



Source: IWAI, 2004

Appendix 3: Viability of Traffic on National Waterway 1 (Allahabad to Haldia)

The majority of the traffic on NW-1 is centred around the inland water port of Kolkata. The traditional base of commercial operations, the barge owners, the CIWTC and the major shipyards and repair facilities are all based in Kolkata. There is some potential for project-based movement of construction material on stretches of the Ganga upstream.

The major problem that barge operators report, including CIWTC, is the non-availability of sufficient draft to operate vessels of sufficient size in an economical manner. Traffic appears to be a secondary concern although because of years of decline in the sector, it is difficult to identify a driving commodity that will sustain the investments in this area. As of now, the private sector is not investing in new barges and the number has declined in the last few years. CIWTC, the largest operator, has submitted a revival package encompassing several dimensions of assets, staffing and technology.

The region has a long history of barge building and maintenance, but the existing facilities, including the CIWTC operated Rajabagan dockyard are not modern and productive as per the standards that the sector requires. There are some improvements in the sector, including the performance of Rajabagan Dockyard (reported by CIWTC) and introduction of fixed schedule operations to gain the confidence of shippers and customers and some new potential traffic, including international trade with Bangladesh.

Source: Authors' visit, 2004.

Appendix 4: National waterway 2

National waterway 2 is the Brahmaputra system from Dibrugarh in Assam to Dhubri on the Bangladesh border and also in Assam. The waterway is entirely in Assam. There are a large number of tributaries of the Brahmaputra, which are also potentially navigable. There is sufficient evidence to show that the Brahmaputra was in fact provided the major mode of conveyance for freight and passenger transport in the region well into the 1900s.

Today, the Brahmaputra carries some freight, but only a small part of the freight traffic carried in the region. This reflects a country-wide shift in all of India from erstwhile viable inland water modes to other modes over the years.

In the case of the Brahmaputra, the concerns of draft availability and the competing uses of water per se, are less than similar concerns in NW-1. A major reason for declining traffic in NW-2 is that the through connection with the Ganga system and mainland India has been lost because of the creation of Bangladesh and also the Farakka barrage. An unfortunate consequence of this in the 1970s was that barge operators could not operate through services and in fact had to effectively abandon some of their vessels in the Brahmaptura as there was not sufficient traffic there and no passage to bring the vessels to the Kolkata area or other areas where they could have been deployed. Even today, the movement of Indian vessels in Bangladesh (and vice versa) is governed by a protocol negotiated between the two governments and renewed every so often. This type of business risk retarded the development of IWT in the region. It is only now that there are signs of Bangladesh opening up its waters for more commerce and barge operators from other regions are considering investments in the area.

The problem of water availability in NW-2 is of a different nature than in NW-1. The Brahmaputra is subject to severe flooding and changing of course at many points. Although the river is sufficiently wide in its entire course from Dibrugarh to Dhubri, it has eroded the banks at many places and does not form a channel of sufficient depth in many places. In a related phenomenon, the river island of Majuli (the largest riverine island in the world) is shrinking year by year because of bank erosion.

The north-east region (the states of Assam, Meghalaya, Arunachal Pradesh, Tripura, Manipur, Mizoram and Nagaland) has severe constraints in transport infrastructure, as far as rail and road are concerned. This is largely because both those modes have to pass through a narrow stretch of land on a circuitous route as far as the main route from Kolkata is concerned. Rail is now served by two single lines up to Guwahati. Road infrastructure is qualitatively better in recent years but is still insufficient to meet the needs of the region. The area is comparatively non-industrialized and therefore relies on imports and shipments from other parts of India for the majority of industrial goods (cement, iron and steel, machinery etc.) The major shipments out of the region are coal from Mizoram, tea, jute and some other agri products.

Apart from the Brhamaputra system, the other riverine system is that of the Barak (Surma) river. This too had a big role to play in transport in the region, again relying on connectivity through (present-day) Bangladesh at Karimganj. This provided good access to commercially important centres like Agartala in Tripura. But today, the Barak river system

is effectively navigable only for 6 months of the year and the through traffic through Bangladesh is again governed by the uncertain protocol arrangements with that country.

The major organized player in the region is the Assam government directorate of Inland Water Transport, under the ministry of Transport. Because of a historical legacy of riverine maritime activity, there is plenty of expertise in barge building, operation and maintenance in the region. The government department also operates its services in NW 1 and in fact has a fleet in operation larger than many players who are based in that region. It is one of the specialized carriers of Over-Dimensioned Cargo.

The Directorate of Inland Water Transport in Assam runs about 75 ferry services in the state. There are private operators too. The extent of traffic has been estimated in 2003-04, only for the government run services as about 24 million passengers and 7.33 lakh metric tons of freight on the ferry services across rivers (mostly the Brahmaputra and the Barak and their tributaries) and about 6 lakh passengers and 57,000 metric tons on long distance ferry services almost entirely on the Brahmaputra.

There appears to be potential for growth in the freight carried by IWT, in a number of commodities such as coal, bitumen and other petroleum products, cement, fertilizer, and food grains as per estimates prepared by the government, but this traffic has not emerged yet in any significant way.

The area of tourism related IWT has seen growth in recent years, with cruises and other types of launches on the Brahmaputra. The most profitable ones are charter vessels run by foreign tour operators, with vessels leased from the government.

Source: Author's visit, 2005, Statistics of the Directorate of Inland Water Transport, Govt of Assam, 2003-04, and Inland Water Transport in North East Region: Water-ways of the North East region, Manuscript prepared by the Directorate of Inland Water Transport, Govt of Assam for the 9th Five-year plan.

Appendix 5: Traffic on National Waterway 3 (Kerala)

National Waterway 3 in Kerala is the smallest of the three national waterways. It is made up largely of coastal backwaters of the Arabian Sea. A large part of this backwater, adjoining the Kuttanad region of Kottayam and Alappuzha districts, has developed a lifestyle that involves multiple use of the waters. A system of gates from both the north (Thanneermukkom) and the south (Trikkunapuzha) controls the extent of salt water that is maintained in the Vembanad lake (of which a large channel is designated as the national waterway) and the waters are used both for prawn cultivation and fishing as well as for rice growing.

There is evidence that water based transport was historically an important, even predominant mode of movement in the past. For many islands in the Vembanad lake, and islands such as Vypeen, off Cochin, water based movements were the only mode for a long time, to transport everything from fresh water to food to construction materials and for trade. Even now, fresh water supply to some islands is done by barge.

Today, there is some movement by water, but with a huge increase in road connectivity and bridges, the primacy of water movement is a thing of the past. In the Cochin area, with the three part Goshree bridges, the islands of Bolghatty, Vypeen and Vallarpadam are connected to the mainland by road, which has already had a big impact on passenger ferry services to those islands. In other areas, the number of passenger routes has declined from about 100 ten years ago to about 30 now.

Apart from commuter movements and local trade through water based transport, there are two other aspects of water based transport that need to be discussed: freight movements and tourism related activities. The major tonnage of freight movement in Kerala is to and from Cochin port to a few industries in the vicinity.

FACT accounts for the large part of this traffic, with two factories on two canals off the main waterway, but which are also considered part of the National Waterway 3, namely the Champakkara canal and the Udyogamandal canal. Raw materials for these fertilizer plants (sulphur, rock phosphate, phosphoric acid and furnace oil) forms the major part of barge movements on NW-3. The other occasional user is Binani for moving zinc. The current rates for these movements (Cochin port to Udyogamandal and Ambalamugal are Rs 55/Ton, which are just enough to cover operating costs of the barges. The movement is possible because FACT has invested in barge handling facilities at both ends, a long time ago.

In earlier days, ammonia gas used to be transported by tanker barges, which is now discontinued. Interestingly, in the past, finished goods from FACT were also transported by barge from the factories to distribution points in Kerala, especially in Kottayam, Alappuzha, Ernakulam and Kollam districts. The barge loading facility is still there, and chute loading is possible at Udyogamandal. These were carried by contractors in 30-40 T country boats upto about 1993. This is viewed as a viable size of shipment even now (compared to 10 Ton trucks), but these operators are no longer present. Carrying sand or converting to houseboats is an option for these vessels. Champakara, Allepey, Chingavanam, Kottayam, Kayankulam, Chenganassery, Aluva and Kaladi are possible locations even today.

Similarly, tanker barges were carrying petroleum products from Cochin port to Kollam, but for reasons of labour management and also problems of the waterway on the southern side, this movement has stopped.

The other major water based commercial activity is tourism, especially houseboat cruises and some amount of water sports. The houseboats are mainly 5-10 capacity freight barges, now converted into vessels for carrying tourists.

There are a few viable private operators in Kerala who are considering investment in the operations in NW-1 (Kolkata region) as well.

Source: Authors' visit, 2004.

Appendix 6: Inland Water Transport in Goa

The tidal riverine system in Goa, comprising the Mandovi and Zuari rivers, the Cumberjua canal and the linkage with Mormugao and Panaji ports forms more than 90% of the commercially viable freight inland water movement in the country. Almost all of this traffic is exported and inland waterways in Goa form an integral part of the competitiveness of the mineral ore export industry. In recent years, higher grade iron ore from mines in Karnataka are also brought to Goa, blended with the lower grade Goa ore and moved by barge to ocean going vessels for export destinations. Hundred percent of this export traffic is handled by barges on the Mandovi and Zuari and although the distances involved are small, the inland water mode of transport is vital to the functioning of the whole activity. This is from two points of view: overall logistics costs and environmental acceptability. As things stand in Goa, options other than inland waterways will be able to handle only a small fraction of the current and projected traffic of iron ore exports. Coal imports and rail movements from the port are slowly increasing and a small (10%) movement of iron ore by rail wagons up to the port may also become possible (with additional planned infrastructure at the port).

The point to note is that the entire movement of iron ore by export is by barge in the Goa sector, even though historically there was rail movement of iron ore right upto the port on the metre gauge railway system. When this was dismantled, barge movement emerged as the primary mode. Apart from the lack of a proper unloading interface at the port, a bottleneck was the line capacity on the rail line section leading to Goa. This has led to the emergence of a dedicated set of barges and loading/unloading infrastructure at several loading points on the Mandovi and Zuari and at Mormugao port.

The analysis also illustrates and emphasizes the supply chain element in transport planning. The interfaces with other modes and an origin-destination view of the flow are essential for a mode to be an effective part of the movement of a commodity. In this case, the inland water mode, together with its interfacing costs, offers a cost competitive way of moving material to the next step in the supply chain (the ocean going vessel that carries bulk cargo for export).

Mormugao port is specifically designed to handle iron ore for export through barge shipments in three different ways; by stacking on the ground and loading on to ships via conveyors, by transferring ore from barges to ships anchored at points called mooring dolphins at the port and finally, by transhippers or own equipment of ships docked at anchorage in deep water locations at Panaji port or Mormugao port limits.

While the movement of iron ore by barge on the river system has been successful, two questions come up in the analysis. One is the reluctance of shippers of other commodities to use this mode. The second is the lack of return flow (i.e. from the port to points upstream). For some years now, at least one bulk commodity, coal, has been moving by rail and truck in the reverse direction. Railway wagons, after dropping iron ore at barge loading points at Sanvordem go empty to Mormugao Port to carry coal in the reverse direction. Coal loading facilities are present at the port and can be designed for barges as well. A possible reason for the unidirectionality of traffic and commodity concentration is the fact that the barges are designed and used for a single commodity and so do not require operations between trips to clean and get the vessel ready for other commodities. Here, the short leads and the barge sizes make it uneconomical for anything other than dedicated commodity vessels with quick turnarounds. In fact, the pressure on turn around can be such that barges are not even

unloaded fully, depending on the material handling system used, before they return for another trip. Figure 1 gives a flow chart of the iron ore movement by IWT in Goa for 2003-04.

Table 1 shows the economics of operation of barges for indicative barge sizes.

Table 1 – Barge Economics (for iron ore operations)

Barge Size	**Tons**	**750**	**1000**	**2000**
Draft	Meters	2.5-2.6	2.8	3.2
Income				
Effective Loading	Tons	750	1000	1800
Trips	number/annum	200	180	160
Throughput per barge	Tons/annum	150000	180000	288000
Rate	Rs/ton	50.5	50.5	50.5
Total	Rs lakhs	**75.75**	**90.90**	**145.44**
Expenditure				
Fuel				
HSD	litres/trip	400	500	650
HSD Rate	Rs/litre	24.4	24.4	24.4
Lube	litres/trip	8	10	10
Lube Rate	Rs/litre	70	70	70
HSD Cost	Rs lakhs	19.52	21.96	25.38
Lube Cost	Rs lakhs	1.12	1.26	1.12
Wages				
Crew size	Number	12	14	18
Wage Cost	Rs lakhs	13.30	14.55	17.00
Annual Repair	Rs lakhs	12.00	15.00	10.00
Running Repairs and Consumables	Rs lakhs	3.00	4.00	5.00
Insurance	Rs lakhs	1.60	2.00	2.40
Taxes and Port Charges	Rs lakhs	2.00	3.00	4.80
Admin Cost	Rs lakhs	3.00	4.00	5.00
Total	Rs lakhs	**55.54**	**65.77**	**70.70**
Operating Surplus (before Interest and Depreciation)	Rs lakhs	**20.21**	**25.13**	**74.74**

Barge Economics Notes

1. The freight rate is fixed between Goa Barge Owners Association (GBOA) and Goa Mineral Ore Exporters Association (GMOEA). The current rate is Rs 49.95/ton with escalations for

fuel (as and when applicable) and variable DA (reviewed every three months). The current escalation for fuel is Rs 0.55/ton).

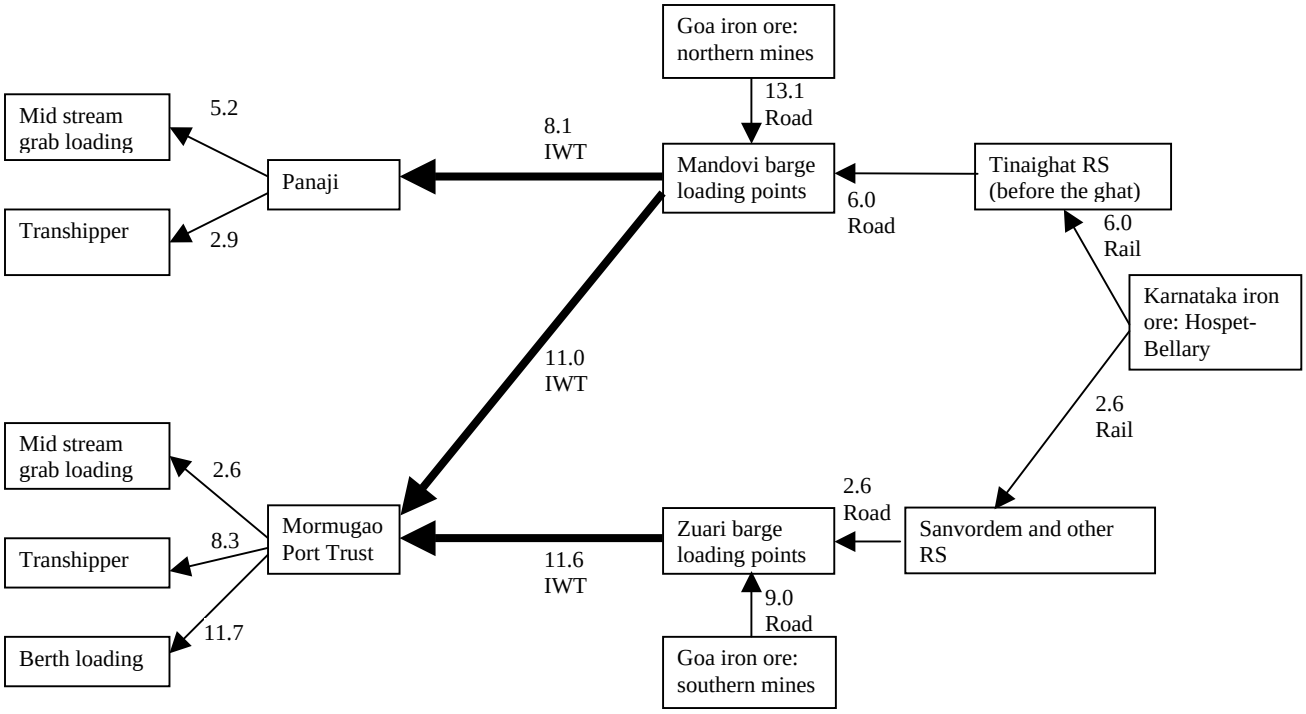
2. Wages are based on agreements between GBOA, GMOEA and the unions.
3. HSD consumption for the three barge sizes based on 12 hours of engine running hours (ERH) per trip, 17, 21 and 27 litres per ERH respectively and twin engines of 200,220 and 270 BHP respectively.
4. 2000 ton barges are classed. They need dry-docking twice in 5 years. (Under IV Act, the requirement is once a year. With special request from the Captain of Ports, it has been relaxed.) Hence their annual repair costs are lower.
5. Cost of Barges: 750 tons (old) Rs 70 lakhs, 1000 tons (old) Rs 120 lakhs, 2000 tons (new) Rs 350 lakhs
6. Interest rate: 11-13%
7. Depreciation is 25%: WDV.

Some factors that have enabled the success and sustenance of inland waterways in Goa are the following:

- Initial use of IWT during the growth of the iron ore mining activity led to the development of the sector. Also, there was significant commercial potential in exports, which turned out to be cost competitive when using inland waterways.
- Proximity of the mines to the Zuari and Mandovi rivers.
- Natural draft of 3-4 meters on the two rivers.
- Rail has not invested in infrastructure to handle the relevant quantities of ore, either on lines (Ghat section to South Goa, lack of rail line in North Goa) or at terminals (loading points in South Goa and at port).
- A good port interface for barges at Mormugao port, including mechanized material handling. Barges also offer multiple options of interfacing with the eventual destination (i.e. ocean going vessels), such as the mooring dolphin and transhippers from barge to vessel at anchorage.
- One commodity (iron ore) in bulk, which allowed a number of efficient systems to be developed and economies of scale to accrue in all aspects of the movement.
- Development of barge building, maintenance and repair activities, including forward integration by mine owners.
- The role of industry forums and associations in ensuring good working conditions, fair wages, acceptable freight rates and safe operating practices (ships certified, crew trained, etc.)
- Environmental concerns about iron ore handling, which made other modes difficult to implement in the Goa stretch of the physical movement.

The Mandovi, Zuari and Cumbarjua system is not a national waterway, but there have been some representations to extend some of the benefits of such a system in the industry here, since it is clearly the most competitive IWT system in the country. State government control but with some central initiatives in the matter of capital subsidy for vessel investment and navigational support would be useful.

Figure 1 Iron Ore Movement by Inland Water Transport in Goa (2003-04)



- All figures are in million tons (mt)
- Exports at Mormugao Port Trust (MPT) were 22.6 mt, at Panaji were 8.1 mt
- Total Goa iron ore production was 22.1 mt. All were exported. 60% were from the northern mines and 40% from the southern mines
- About 1 mt of Karnataka ore was blended with Goan ore for exports. The remaining 7.6 mt were exported directly, mostly through Panaji
- Ore from Mandovi loading points moved to MPT, both via the sea route from the Mandovi mouth and the midway Cumbarjua canal route

Source: Authors' visit, 2004; GMOEA, 2004; Raghuram and Rangaraj, 2005

Appendix 7: IWT on Irrigation Canals in India

After the early irrigation canals on the Ganga system in India, it appears as though some of the interim canal development in the country was in fact planned with navigation and transport in mind, apart irrigation and other uses of water. This applies to the Damodar Canal and the Kakinada/Eluru Canal, in particular. Subsequently, these canals have not retained their navigable condition for a variety of reasons.

Currently, the newer canal system on the Narmada is the one that offers technical scope for navigability. The major constraints to navigation are the presence of flow regulators, bridges and other structures at regular intervals. A 1991 TIFAC study suggested that the technical requirements to overcome these constraints and costed it at Rs 101 crores for the first 230 km (Sardar Sarovar Dam to Ahmedabad) and 137 crores over the next 207 km until the Rajasthan border. The navigable minimum draft of the canal in the first segment is expected to be 7.3 m with a minimum width at the bottom, of 59 m. and for the second segment, 5.55 m and 10.8 m respectively. The second segment dimensions would enable double lane movement of specially designed six hundred T barges.

Source: TIFAC, 1992.

Appendix 8: Statistics of IWT

Excepting for Goa, cargo carried through IWT in other riverine States is not significant. Data compiled on the basis of the reports of cargo movement by IWT received from Mormugao Port Trust reveals that about 15.69 million tones of cargo constituting mainly Iron Ore was moved during 2000-01 as compared to 14.87 million tones in 1999-2000. In addition 71 lakh passengers also used IWT in 2000-01 as against 69 lakh passengers in 1999-2000.

West Bengal and Kerala are the other two important states where IWT operations take place. According to the data received from IWT Directorate, Govt. of West Bengal, for 1999-2000, about 56 million passengers and 1.04 million tones of cargo were moved by mechanized vessels deployed for movement of cargo and passengers. The major operations (based in West Bengal) are CIWTC (Govt. of India undertaking), Vivada Inland Waterways Ltd., and Eastern Navigation Ltd. etc. Of the total passengers moved through Inland Waterways, more than 42% were carried by Hooghly Nadi Jalpath Paribahan Sarmabaya Samity. This was followed by West Bengal Surface Transport Corporation (a Govt. of West Bengal agency) Indo-Swiss Trading Corporation Co. Ltd. Details have been brought out in Section 4.

In Kerala State, the cargo movement is through NW-3 in addition to other water stretches. Cargo handled on NW-3 has marginally decreased from 1.11 million tones (1999-00) to 1.09 million tones (2000-01). Some of the major IWT operators on NW-3 are KSINC, ABC & Sons Ltd., South India Company and Amrok Shipping. The commodities carried include Bulk Raw Material, POL, LDO/FO etc.

Kerala Shipping & Inland Navigation Corporation Ltd. (KSINC) is the major contributor in handling cargo in NW-3. During 2000-01, KSINC handled 0.55 million tones of cargo as against 0.59 million tones of cargo in 1999-00. In addition, KSINC also moved 5.72 million passengers in 2000-01 as compared to 8.65 million passengers in 1999-00.

Based on the available data, it is noted that nearly 18 Million Tones of cargo was moved through IWT during 2000-01. The major contributors to traffic are given below:

Sl no	**Name of the organization**	**Quantity of cargo moved** (million tonnes) in 2000-01
1	Central Inland Water Transport Corporation	0.11
2	Vivada Inland Waterways Ltd.	0.25
3	Kerala Shipping and Inland Navigation Corporation Ltd.	0.55
4	Goa Barge Owners Association & Goa Minerals Ore Exporters Association	15.69
5	Other States	1.26
	Total	17.86

Source: TRW, 2002.

Appendix 9: Policy Initiatives in IWT

We summarize some of the key recommendations and statement of initiatives from the IWT Policy statement of the Ministry of Shipping and the Planning Commission Working Group on IWT.

A. IWT Policy Document: Ministry of Shipping (2001)

A.1 Measures taken so far to develop IWT

1. Various developmental activities to improve inland water transport system are being carried out:

- In National Waterway 1, navigable depth of 2 meters is maintained on the stretch from Haldia - Farakka - Patna (1020 km) for about 330 days in a year.
- In National Waterway 2, depth of 2 meters is maintained between Dhubri and Pandu (260 km) for about 330 days a year.
- In National Waterway 3, capital dredging is in progress after completion of which depth can be maintained.

2. Inland water transport has been accorded the status of infrastructure so as to enable it to avail itself of concessions applicable to other infrastructure sectors.
3. An outlay of Rs 408 crores was provided in the 9th Plan.
4. CIWTC, Kolkata, a public sector undertaking, is the principal inland water operator.
5. Work on setting up a National Inland Navigation Institute in Patna for training manpower is in progress.

A.2 Further policy support for accelerated IWT growth

1. IWAI is being authorized to raise bonds to enable IWAI to borrow from the market and mobilize funds.
2. It has been decided to enlarge the role of IWAI to enter into commercial/joint ventures to encourage investment in this sector, subject to financial exposure of the Govt being limited to equity participation.
3. Equity participation by Govt of 40% on BOT projects.
4. Grant of 100% tax exemption to investors for five years.
5. Enhancement in depreciation rate for inland vessels.
6. To encourage IWT fleet expansion, vessel building subsidy of 30% is provided for ship owners for inland waterways built in Indian shipyards.
7. Levying minimum customs duty on imported equipment and machinery

B. Report of the Planning Commission Working Group on Inland Water Transport (2001)

B.1 Objectives and strategy of the 10th Plan

1. Stabilising, strengthening and upgrading the infrastructure on the existing three National Waterways in terms of river management and control, provision of required navigable depth (LAD), terminals with mechanical handling facilities, navigational aids.

2. Declaration of at least new National waterways and extension of NW-3.
3. Development of 8 river ports at strategic locations and development of cargo oriented terminals and handling facilities.
4. Development of Kolkata port as a Central Inland Port for eastern and north-eastern region.
5. Providing port hinterland connectivity through IWT.
6. Creation of interface between shipping, coastal shipping and IWT.
7. Provide thrust of development of water card tourism.
8. Synergizing the resources of various organizations like IWAI, CIWTC, CONCOR, etc
9. IWAI has been entrusted the responsibility of development and regulation of the inland waterways for shipping and navigation. Thus the function of IWAI would not be limited to providing fairway and infrastructure facilities in National waterways.

B.2 Review of CIWTC and IWAI

1. IWT in India has gradually declined due to various reasons, lack of investment for creation of infrastructural facilities and lack of efficient IWT operators being major contributory factors.
2. CIWTC has been a loss making organization since its inception in May 1967. Only 59 of the 101 vessels of its River Service Division are reported to be in working condition. Due to various reasons, the productivity by CIWTC vessels has not been improving.
3. Performance of Rajabagan dockyard and Deep Sea Repair Division too had not been satisfactory and these Divisions contributed to the CIWTC becoming a regular loss making organization.
4. A restructuring and revival plan of CIWTC has been formulated by M/s AF Ferguson.
5. IWAI is an autonomous organization constituted in October 1986. IWAI has shown reasonable improvement in terms of expenditures. This expenditure was incurred mainly on provision/maintenance of fairway, terminals and navigational aids on three National Waterways, Techno-economic feasibility studies on other waterway systems, loan assistance, etc.
6. This improved financial performance has not resulted in a substantial improvement in infrastructure on National Waterways or in a proportional increase in utilization of inland waterways mode in terms of cargo moved by IWT mode.
7. By increasing its staff strength and by restructuring it with a view to make it goal oriented, further enhancement in its performance can be expected.
8. The private sector involvement for development of this mode and operation of cargo vessels was not at all satisfactory.

B.3 Transit and Trade between India and Bangladesh

1. The protocol on inland water transit and trade between India and Bangladesh has been operational since 1972 and is renewed every 2 years. Under the protocol four Ports of Call in each country have been nominated. It provides for 50:50 sharing on tonnage basis for inter-country and transit cargo. The protocol also permits the movement of goods and barges/vessels of the countries through 8 specific inland water routes.
2. Development of Khanpur jetty in Bangladesh can be considered as Joint Venture project between India and Bangladesh. India may invest in the project while Bangladesh may operate and maintain the jetty.

3. The transit and trade route passes through Sunderbans (India) which is not declared as National Waterway. Thus there are certain difficulties in maintenance of fairway and channel marking/night navigation on this route.
4. CIWTC has a large fleet of vessels but more than 50% of its vessels are out of order and they have also not transported appreciable quantity of cargo.
5. The Govt of India provides Bangladeshi Taka 200 lakhs annually to the Govt of Bangladesh to maintain the fairway on Bangladesh side.
6. Night navigation facility is available only in certain patches of Bangladesh waters. In NW-2 implementation of scheme for providing night navigation facilities has been delayed and performance of lighted buoys is not satisfactory.
7. Floating terminals at five locations have been provided in NW-2. Permanent terminals with mechanized cargo handling facilities and container handling terminals are required in NW-2 and Kolkata.
8. Manpower for traffic regulation and manning of vessels needs to be strengthened. Proper training facilities for IWT personnel are to be strengthened.
9. Vessel repair facilities are available only at Kolkata and it is difficult for vessels to get proper and timely repair in NW-2.
10. Movement of cargo has declined in the past few years. Import of cargo from Bangladesh has declined whereas export has substantially increased.
11. To boost the traffic potential, integration of coastal shipping and interlinking of waterway, specially Sunderbans and Barak river, is to be taken up.
12. In order to bring the freight structure of IWT at par with rail freight, subsidy is essential.
13. The private sector involvement for development of IWT mode and operation of cargo vessels was not at all satisfactory.

B.4 Training Facilities

1. The issues relating to competency and grant of certificates relating to Inland Vessel Crew must be reviewed in detail.
2. Training of IWT personnel both on the shore side and on board Inland Mechanically Propelled Vessels (IMPV) is a crucial requirement of HRD in IWT. Facilities for induction training exist at Goa and Orissa whereas those for in-service training exist only at Goa. Training should be harmonized to provide mobility of personnel from one state to another.
3. The National Inland Navigation Institute (NINI) at Patna should be developed urgently to a center of excellence. NINI should establish and maintain liaison with other national and international institutes of repute to get best use of facilities and expertise available. NINI should be funded entirely by the Central Govt.
4. Central and State Govts should encourage the setting up of IWTs in the private sector but ensure that norms and standards are met.
5. It is necessary for each person working on IMPVs to undergo four basic safety courses. Ability to swim is also essential.
6. It has been estimated by IWAI that the 2000 IMPVs, envisaged by the end of the 10^{th} Plan, would need about 4000 persons at various levels to man the vessels.

Source: As given above