

CLIMATE CHANGE AND INLAND NAVIGATION IN BANGLADESH

INFORMATION BRIEF



Photo: IUCN / Abdul Quayyum

KEY POINTS

- Rivers are an important mode of transportation in Bangladesh.
- It is predicted that climate change, through increased sea levels, increased flooding and increased sediment deposition, will change the condition and paths of water ways in Bangladesh.
- More research is essential to ascertain likely scenarios and impacts.

INTRODUCTION

Climate change constitutes one of earth's most fundamental challenges and will remain so for the decades to come. Bangladesh is globally known as one of the most vulnerable countries to climate change.

Situated in the lower end of the three great rivers, the Brahmaputra, the Ganges and the Meghna, Bangladesh is one massive alluvial flood plain criss-crossed by a network of several rivers, their numerous tributaries and canals. Inland water transport (IWT) is a very important mode for maintaining transport link between the various remote parts of the country and at the same time a means for transporting export-import cargo as well. Transport sector incorporates about 8.27% of GDP and from water sector specifically contributes about 0.64% of total GDP.¹ IWT has become more accessible and cheaper than roads and railways and the poor people use this mode more.

IWT is environmentally friendly and consumptions of fuel is four to eight times lower than that of roads. CO₂ emission by engine of inland ship is also lower making a positive impact upon the environment.

However, gradually the flow of waterways has become alarmingly erratic causing huge siltation in the rivers. As a result inland navigation is becoming hazardous and waterways shrinking rapidly. The change in waterways is very much evident and visible. NEDECO (1963)² study shows 12,000 km of navigable waterways in 1960s. Another study³ in 1989 shows about 6000 km of waterways are navigable, of these vessels could negotiate only 3800 km during low water period. Presently waterways have reduced to about 4500 km of

which not more than 2500 km can be used for navigation in the lean period. The requirement for maintenance dredging is growing very high beyond the national capacity in hand. IWT Master Plan Study by the Planning Commission in 2009⁴ estimated 18 million cubic meter annually. Rivers have become so unpredictable that even dredging could not yield benefit for navigation.

INLAND WATER TRANSPORT SECTOR

Total inland navigation transport area is about 24,000 km and it varies during monsoon (about 5968 km) to dry season (3865 km). Transport of passenger and cargo is the main service provided by the sector. Bangladesh Inland Water Transport Authority (BIWTA) estimated and recorded cargo and passengers handled at 21 River Ports operated by BIWTA by both private and public sector vessels. The data shows steady increase in the sector (Table 1).

Table 1: Year Passenger and Cargo Handle at River Ports

Year	Passenger (in million)	Cargo (in million tonne)
2005-2006	166.10	17.60
2006-2007	178.11	20.04
2007-2008	189.80	24.51

Source: BIWTA Year Book 2007-2008

However, compared to other transport sector, the World Bank Report⁵ found that IWT share is decreasing (Table 2). The share of passenger decreased from 16% to 4% in 30 years and the same for cargo decreased from 38% to 15%. It is to be noted that the figures do not reflect the contribution from the unregistered boats, which can be significant.

Table 2 Modal Share of Three Modes in Total Transport Sector

	Passenger Traffic Pass-Km (Billion)							Cargo Traffic Ton-Km (Billion)						
	Total	Road	%	Rail	%	IWT	%	Total	Road	%	Rail	%	IWT	%
1975	17	9.2	54	5.1	30	2.7	16	2.6	0.9	35	0.7	28	1	38
1996	66	52	79	3.9	6	10.1	15	10.7	6.9	64	0.8	7	3	28
2005	111.5	98.4	88	4.2	4	8.9	8	19.6	15.7	80	0.8	4	3	15

¹ BBS. (2008). *Statistical Yearbook of Bangladesh*, Bureau of Statistics. Dhaka, Bangladesh.

² NEDECO. (1963). *Inland Water Transport Master Plan Study*. East Pakistan Inland Water Transport Authority. Netherlands Engineering Consultants (NEDCO).

³ IWT Master Plan. (1989). *Inland Water Transport Master Plan Study Report 1989*. Bangladesh Inland Water Transportation. Prepared by DHV Consultants.

⁴ Planning Commission. (1989). *Inland Water Transport Master Plan Study, Final Report*, Government of the People's Republic of Bangladesh, Transport Sector Coordination Wing, Ministry of Shipping.

⁵ World Bank. (2007). *Revival of Inland Water Transport: Options and Strategies*. Bangladesh Development Series, Report No. 20. People's Republic of Bangladesh.

Statistics from BIWT shows that over 63 million people are involved with IWT sector, of which 10% is assumed to be women working in the landing stations.

Table 3: Employment in IWT Mode (Figures in number)

Sector	Employment
Public Sector	
Bangladesh Inland Water Transport Authority	4000
Bangladesh Inland Water Transport Corporation	5000
Department of Shipping	60
Private Sector	
Landing Stations	668,000
Inland vessels	75,000
Dockyards	101,000
Country boat and Mechanized country boat	5,500,000
Country boat yard	10,000
Total	6,363,000

The study by World Bank reveals that in terms of productivity per kilometre of network, railway is the best mode followed by IWT and road. IWT has more than twice the productivity of roads for cargo.

Table 4: Productivity among Road, Railway and IWT

Intermodal Comparison	Road	Railway	IWT
Network (km)	2,74,000	2,800	24,000
Productivity per km of network			
- Passengers-km	3,59,000	15,00,000	3,69,000
- Tons-km	57,000	2,93,000	27,000

IMPACTS OF CLIMATE CHANGE ON INLAND NAVIGATION AND ECONOMIC LOSSES

According to the Bangladesh Climate Change Strategy and Action Plan (2009)⁶, followings are the possible impacts of climate change in Bangladesh:

- **increasingly frequent and severe tropical cyclones**, leading to more damage in the coastal region;
- **heavier and more erratic rainfall** in the Ganges-Brahmaputra-Meghna system, including Bangladesh, during the monsoon resulting in higher river flows, causing over-topping and breaching of embankments and widespread flooding;
- **river bank erosion** resulting in loss of homes and agricultural land to the rivers;

- **increased sedimentation in riverbeds** leading to drainage congestion and water-logging;
- **melting of the Himalayan glaciers**, leading to higher river flows in the warmer months of the year, followed by lower river flows and increased saline intrusion after the glaciers have shrunk or disappeared;
- **lower and more erratic rainfall**, resulting in increasing droughts, especially in drier northern and western regions of the country;
- **sea level rise** leading to submergence of low lying coastal areas and saline water intrusion up coastal rivers.

To determine the impact of the climate change on inland water transport, studies should be conducted for adapting to climate change. Some impacts envisioned due to climate change are:

- Loss of navigability due to increase in frequency and duration of dry spell (drought) may imply higher prices and losses;
- Increase in frequency in wet and stormy period may imply higher costs due to weather disturbances and safety;
- Gradual low flow conditions and resulting economic losses;
- Large variations and reduced water depth;
- Sharp increase in frequency of extreme costs;
- Damage from cyclone and storm surge to IWT infrastructures.

Challenges Faced by BIWTA

Impact on Navigability: Navigability of rivers in Bangladesh has been deteriorating over a long period. Both natural and morphological processes and the withdrawal of water from the river beyond the border and within Bangladesh for irrigation and other purposes have resulted in a decreased dry season navigability of the rivers, channel depths turned out to gradually decline. The DHV Consultants estimated the requirements for development and maintenance dredging ranging from 2.25 to 7 million cubic meters annually during 1988-2005. While in 2009 the Inland Transport Master Plan study by the Transport Sector Coordination Wing of the Planning Commission estimated a total volume of dredging requirements up to 18 million cubic meters annually.

⁶ MoEF.(2009). *Bangladesh Climate Change Strategy and Action Plan, 2009*. Ministry of Environment and Forest (MOEF), Government of the People's Republic of Bangladesh.

According to reports gathered from BIWTA it was revealed that in most cases sustainable navigability could not be achieved by dredging. Deposition of silts hindered the navigability in certain stretches immediately after the dredging. As such BIWTA has to struggle for maintaining the navigability.

The IWT corridor between Dhaka-Narayanganj and Chittagong maritime port is of prime national importance as class-1 with a guaranteed LAD of 3.6 m. The waterways have adequate navigational draft for most of its length during low water period except for spots where depositions of silts take place. One of such chronic problem spots lies near Hizla in the lower Meghna river. The vessels plying between Dhaka-Narayanganj and Chittagong have to wait for the high tide.

The next Corridor in importance is the waterways between Dhaka-Narayanganj to Mongla-Khulna. It is also the route that connects the capital with Barisal. Classified as class-1 it ensures a LAD of 3.6 m. But the approach to Barisal inland port is known to suffer from acute siltation and requires maintenance dredging every year. In this route the Mangla-Ghasiakhali canal is identified as a chronic problem spot where vessel can only negotiate during the high tide even in the high water period.

The inland waterway corridor to the north-eastern part of Bangladesh specially to Chhatak and Sylhet, is classified as class-1 up to Bhairabazar and reduces thereafter to depths ranging from 2.1 m to 1.5m which levels further decreases during the low water period. The vessel owners are compelled to sail at half or three quarter of the loading capacity. Baghabari port is of national importance. Much needed fuel and fertilizer are distributed to the northern part of the country through this point. The Baghabari-Paturia routes (Jamuna/Baral, Harasagar river) has been behaving

erratically and unpredictably in recent years posing problems and sometimes threat to uninterrupted vessel movement.

It also appears from information given by BIWTA that navigational depths in some 1000 km of classified routes, mostly belonging to class-iv routes, reduces to such extent during low water period that those became unsuitable to negotiate even by the vessel with less than 1.5 m draft. Vessels can hardly negotiate in the routes classified as class-iv even during the monsoon.

BIWTA officials and IWT operators also maintained that through comprehensive hydrographic survey it will be revealed that total length of navigable waterways during the monsoon will not exceed 4000-4500 km of which 2000-2500 km are navigable during the low water period.

Shifting of Channels: Despite BIWTA's aid to navigation support along the channel, change of river course has become almost unpredictable. As a result vessels are grounded often cause huge economic loss for the vessels operators. Presently BIWTA performs Hydrographic Surveys only in the routes and areas which require priority attention. Hydrographic survey or other related investigations as such have not been carried out over a vast portion of the IWT network in recent years. However officials and IWT operators opine that navigation during high water periods does not usually face any problem. In the low water season, although there exists long stretches of waterways in the sufficient depths, sedimentation and shoals appear in many places that restrict movement of the vessels.

Damage to infrastructures: Impact of climate change is very much evident in case of 24 terminals developed by BIWTA in the early 1970s which were also used as cyclone shelters. Not a single terminal is now in use as the rivers lost navigability or change their courses far away from terminals.



The equipments (e.g., aid to navigation) are vulnerable to flood, storm surge and cyclone. Aid to navigation equipments are being washed away regularly by onrush of flood water. SIDR in 2007 destroyed, damaged or washed away about 80% of the navigational aid equipments installed in the waterways in Barisal and Khulna divisions.

BIWTA so far developed 21 inland ports and 380 landing stations. The list of BIWTA installations can be seen in Table 5. About 43% of the landing stations were developed in the rural areas of Barisal Division. About 35 landing stations are located in the rural areas of the districts of Khulna, Bagerhat and Satkhira. About 30% of these landing stations were damaged, pontoons were displaced, damaged or capsized during SIDR as well. Landing stations located in the coastal area exposed to saline intrusion. Floating pontoons, jetties or shore connection cannot last long due to salinity of the water.

Table: 5. List of BIWTA Installations

	Installation	No
1.	River port	21
2.	Landing station	380
3.	Pilot station	26
4.	DGPS station	05
5.	Ferry terminal	08
6.	Ferry point	17
7.	Building	396
8.	Waiting shed	38
9.	Jetty	225
10.	Gangway	55
11.	Shore connection	130

Obsolete Inland port and landing Stations: The river ports and landing stations developed at the banks of the rivers need to be developed considering impacts of climate change. The design of these installations is dictated by the difference in water level between dry season and the wet season, which varies locally and may be in the magnitude of 6 meters. In coastal area the difference in water level is further amplified by tidal action. The banks of the river slope gently towards the centre line of the river, necessitating long jetties to serve river craft in water with sufficient depth. A further significant factor in shaping the structure of the jetty is the method of cargo handling which is done almost exclusively by head-load. Following the benchmark of Public Works Department (PWD) BIWTA developed ports and landing stations facilities calculating the high water and low water variation.

As climate change factors were not considered, already in some places, it can be seen that the facilities which were developed in the past are now on the shore quite away from the river or in the mid-stream of the river without any shore connection. Floating pontoons are

often shifted to another place due to change of course of river or due to erosion leaving behind the piles or spuds.

Hazardous locations: When BIWTA struggle to maintain the navigability, at the same time at some places vessels struggle to negotiate against strong current. In the late monsoon or due to flash flood discharges of water and roughness of water increase in some stretches to such extent that navigation becomes very dangerous. One of such example is the confluence of Meghna and Dakatia near Chandpur port. A dangerous whirlpool develops there caused at least half a dozen of marine accidents in the recent years and claimed thousands of lives.

RESULTANT IMPACTS AND ECONOMIC LOSSES

The people of Bangladesh learnt to depend upon waterways not only for drinking water, agriculture, foods, shelter but also for passage of goods and passengers from one place to other. In fact transportation in this part of the world started with the rivers. Inland waterways have become a very important mode for not only maintaining transport link between the various remote parts of the country but also as a means for transporting import and export cargo. IWT has proved more accessible and cheaper than roads and railways and the poor people use the mode more. A World Bank study conducted in 2007 revealed that 12.3% of rural population or 50% of all rural households have access to water transport. Due to its natural advantage over the other two surface modes (roads and railway); IWT is in a position to contribute significantly to the Government effort for the growth and reduction of poverty. Impacts of climate change on navigation therefore has detrimental effects on transportation of goods and materials.

MANAGING CLIMATIC HAZARDS

Mitigation

Generation of greenhouse gases (GHG) in Bangladesh is low. In the transport sector of Bangladesh emission of CO₂ by inland vessel is the lowest. It means more use of waterways for the purpose of transport will result in increased saving in fuel and less emission of CO₂. In 2005 IWT sector achieved a savings of 155,000 tons of CO₂. Even than there exist opportunities in reducing emissions.

In Bangladesh, like other developing countries, IWT performance is achieved with old engine technology which means efficiency of fuel consumption can be

achieved. This improvement would make IWT more competitive and would increase the transfer from road sector to IWT, further reducing the impact on carbon footprint of the sector.

Technological developments with regard to i) vessel operation, ii) vessel design, iii) engine efficiency and propulsion system, and iv) alternative fuel options must be reviewed. Energy efficiency gain can be realized through each of these categories against increased investment costs.

Adaptation

The navigators of Bangladesh have adopted through experience to navigate in the deteriorating conditions of the river. Such conditions increase the cost of the maintenance of vessels and of infrastructure and allied services. Due to increased cost for maintenance of the vessels, owners have decreased the cost for safety. As a result marine accidents have become regular incidents in inland navigation. BIWTA the public authority responsible for development, maintenance and operation of inland water transport cannot meet the increased demand for maintenance of waterways and of ports and landing facilities due to paucity of fund.

In the mean time, maintenance of navigability of the waterways must be carried out carefully. Dredging technique and dredging method should be determined in a manner that can adapt to the erratic conditions of the rivers due to climate change. Through morphological and social studies dredge spoil may be discharged to raise the river banks. For sustainable navigability river training work should also be carried out as well.

Through practical experience it was evident that bandalling in some stretches of rivers may develop navigability to some extent. As such bandalling programs should be carried out where feasible.

Facilities in the river ports and landing station should be made flexible in a way to adjust the changing conditions of the rivers due to climate change.

Due to climate change river will be more meandering and bed will be raised to such extent that will restrict smooth navigation. For adapting the changing condition of the river, design and dimension of the vessel must be changed. The breadth of a vessel may remain unchanged but the draft and the Length Overall (LOA) must be changed. Deeper draft long vessels must be replaced by flat bottom with shorter LOA vessels.

FINANCING ADAPTATION IN INLAND NAVIGATION

Public expenditure in IWT is too low compared to its modal share or contributions to the national economy. In the surface transport sector development allocation for IWT was 5% annually on an average. After the completion of the IWT-III projects financed by the World Bank in 2000, BIWTA did not implement any project financed by any development partners. Moreover, for adapting to the climate change in the IWT there exists neither action plan nor any fund. Although recently BIWTA received an allocation of BDT 210 million from the Climate Change Trust Fund to remove the garbage deposited on the beds of the rivers around Dhaka city.

The finance for adaptation and mitigation in the IWT sector has to come from the global source on a purely grant basis. To this end the Ministry of Environment and Forest responsible for working out the cost of implementing the climate change Action Plan must include the IWT sector in consultation with the Ministry of Shipping.

POLICY AND INSTITUTIONAL ARRANGEMENT

Policy Considerations

The shipping policy was formulated in 2000 wherein development maintenance and operation of inland ports and use of inland waterways were included but it did not include the strategy or action plan for adaptation of the climate change. Transport Sector Coordination Wing of the Planning Commission published the Inland Water Transport Master plan Study just one year back in 2009. It included everything about the development need and development plan.

According to the terms of reference (TOR), the study drafted an inland water transport policy as well. But the most visible threat of inland shipping, i.e., the impact of the climate change was absent. In the TOR "assessment of any constraint along major corridors" was included but it did not mention or include the impact of climate change. More surprisingly the Bangladesh Climate Change Strategy and Action plan 2009 which achieved appreciations around the world did not mention anything about inland water transport and of inland waterways.

As a result in the planning and implementation process for development of inland water transport, assessment

of the impact of climate change does not exist. No GOB agencies have so far undertaken any study or any effort to this end. Due to the unavailability of data modelling, scenario limitation and lack of coordination it is very hard to highlight the impact of climate change on IWT.

Public and Private Bodies Related to IWT

There are many factors that influence water qualities of the inland water system. Department of Shipping (DOS) is the principal entity responsible for:

- Ensuring environmentally sound development and maintenance practice in the IWT sector;

- Identifying and regulating activities that pollute and degrade the environment;
- Ensuring long time use of inland water resources without adversely affecting the eco-system.

It is essential that DOS ensures is maintains these responsibilities through further research into how climate change will affect these water ways in the future. Public and private bodies related to development, maintenance and operation of inland water transport may be seen in Table 6.

Table 6: Public and Private Sector Organisations related to IWT

Public Bodies	Responsibilities
Bangladesh Inland Water Transport Authority (BIWTA)	Development, maintenance and control of inland water transport and of inland waterways
Bangladesh Inland Water Transport Corporation (BIWTC)	Carriage of passenger and goods as a public corporation. Presently only engaged in ferry operative between road, heads and in passenger service in Dhaka-Barisal-Khulna route. Cargo vessels, oil tankers and sea-tracks owned by BIWTC have been leased out to private operators
Department of Shipping (DOS)	As a public regulatory body regulates construction of ships, inland navigation and safety
Private Bodies	
Bangladesh Cargo Vessels Owners' Association (BCVOA)	Carriage of cargo by vessels registered under Inland Shipping Ordinance (ISO), 1976
Bangladesh Coastal Ship Owners' Association (BCSOA)	Carriage of goods mainly from maritime ports to inland destination by vessels registered under merchant Shipping Ordinance (MSO), 1976
Bangladesh oil tanker Owners' Association (BOTOA)	Carriage of Pol and liquid bulk by vessels registered under ISO and MSO
Bangladesh Inland Water (Passenger carrier) Association (BIWPCA)	Carriage of passengers by vessels under ISO
Launch Owner' Association Bangladesh (LOA)	Carriage of passengers by vessels under ISO
Engine and Bulkhead Boat Owners' Association	Carriage of goods, passengers and extraction of sand from the river mostly by informal boats.
Country Boat Owners Association	Carriage of passenger and good by informal boats.

CONCLUSION AND RECOMENDATIONS

Inland water transport provides transportation access to about 25% of rural households in Bangladesh. Considering the economic viability, inland navigation facility is comparatively cheaper than the other available transport system. The external cost is low and IWT is environmental friendly, requires minimum maintenance and is a safe transport option. Considering the developmental issues, inland navigation transport facility has been under developed due to the overwhelming development of the road transportation system. Road network is responsible for deteriorating of many previous navigable routes due to the blockage of water transport.

It is thought that climate change, through increased sea levels, increased flooding and increased sediment deposition, will change the paths of water ways in Bangladesh. Exactly what will happen is still unknown. It is essential more research is done to ascertain likely scenarios.

To ensure adaptation to reduce the vulnerability to climate change on inland navigation and shipping this paper recommends the following:

- Conduct a study to ascertain the impact of climate change on inland water transport (navigability, port, landing stations) and to draw up an action plan for adapting to climate change and mitigation.

- Constitute a core committee for challenging the climate change ensuring representation from Ministry of Shipping, Ministry of Environment, Ministry of Forestry, Ministry of Water Resources, Bangladesh Inland Water Transport Authority and Trade Bodies.
- There should be climate change cell in the Ministry of Shipping and in the agencies to determine the impact of climate change.
- Dredging technique and dredging method should be determined wherein raising of river banks with dredge spoils be considered.
- Vessel operation, vessel design engine efficiency and alternative fuel options should be reviewed to reduce the emission of carbon. Given the fuel/carbon efficiency of the IWT sector should be utilized to support growth of the sector.
- River training for the purpose of navigation and the programs for bandalling should be undertaken where it is feasible.
- Facilities at Ports and Landing Stations should be made flexible so as to adapting the impact of climate change.
- Present deeper draft long vessels should be replaced by flat bottom shallow draft vessel. In this regard research should be conducted.
- Laws, rules and regulations to protect the environment should be enforced in coordinated and intensive way with regard to inland shipping.



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