



Port Hinterland Connectivity, the Role of Inland Waterways a Bangladesh Perspective

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ARTICLE INFO

Article history:

Received 08 August 2016;
in revised form 18 August 2016;
accepted 21 November 2016.

Keywords:

Port development, Hinterland connectivity, Inland waterways, Performance and Logistics.

ABSTRACT

Bangladesh is becoming more and more a trading nation. The latest data of World Bank shows the share of import-export is 40% of the GDP. As international trade has a strong linkage with maritime trade, the same is observed here is Bangladesh as well. Sharp increase in the figure of cargo handling both bulk and containers in the maritime ports indicates the adequacy of the significance of international trade in economic development. In order to keep pace with the incremental trend of international trade in parallel to the maritime port development its hinterland connectivity is also necessary to establish requiring huge investment in different modes of transports like road, rail and inland waterways. A country with high population density as well as the largest delta of the world would be more cost and environment effective to diverse more and more cargo to inland waterways. This paper has been structured by reviewing the importance of hinterland connectivity in relation to port operation, port efficiency as a whole port development followed by a brief discussion of the international trade pattern of Bangladesh. Later on a comparative analysis of the performance of different modes of surface transport in facilitating the hinterland services of the Maritime Ports has been highlighted here. Finally comparative advantages of inland waterways to compliments other modes of transport as well as a logistical approach of overcoming the drawbacks it possesses.

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1. Introduction

Bangladesh is becoming more and more a trading nation. The latest data of World Bank shows the share of import-export is 40% of the GDP (The World Bank, 2016). As international trade has a strong linkage with maritime trade, the same is observed here is Bangladesh as well. Sharp increase in the figure of cargo handling both bulk and containers in the maritime ports indicates the adequacy of the significance of international trade in economic development. In order to keep pace with the incremental trend of international trade in parallel to the maritime port development its hinterland connectivity is also necessary to

establish requiring huge investment in different modes of transports like road, rail and inland waterway transport (IWT). A country with high population density as well as the largest delta of the world would be more cost and environment effective to diverse more and more cargo to IWT.

There are about 24,000 km of waterways in Bangladesh that cover about 7% of the country's surface. Most part of the country is linked by a complex network of waterways which reaches its extensive size in the monsoon period. The waterways have accessibility to such remote areas where road and railways do not have that connectivity. More than fifty percent of the economic activities in the country are located within a distance of 10 km from the nearest navigable waterways in all seasons. The high degree of penetration of the IWT network is providing access to about 25% of the rural household in Bangladesh. This is also the main mode of transport in the north eastern haor areas and south coastal areas where the road network is less developed. As a result, the water transport network caters to the

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inland movement of freight and passengers as well as plays an important role in the transportation of import and export items through the ports of Chittagong and Mongla. IWT is also in better position compared to road and rail in the aspects of cost and fuel savings and less accident prone as well. It costs Tk. 1.00 for IWT, Tk. 4.5 for road and Tk. 2.5 for rail to transport per ton cargo per km. The use of IWT could save about 58.5 million liters of diesel and 155,000 tons of CO₂ per year (The World Bank, 2007).

Having such an advantageous position the performance of IWT compare to other modes are far behind from its potential. Out of the 24,000 km of rivers, streams and canals only about 5,968 km is navigable by mechanized vessels during monsoon period which shrinks to about 3,865 km during dry period. The varying nature of hydraulic characteristics along with low investment in maintaining and developing the sector discussed as the prime reasons of such low productive situation. The share of passenger and cargo performance for IWT which was respectively 15% and 30% of total in 1995 has drastically reduced to 8% and 16% in 2005 (The World Bank, 2007).

This paper has been structured by reviewing the importance of hinterland connectivity in relation to port operation, port efficiency as a whole port development followed by a brief discussion of the international trade pattern of Bangladesh. Later on a comparative analysis of the performance of different modes of surface transport in facilitating the hinterland services of the Maritime Ports has been highlighted here where the present performance of IWT and its prospects as a whole has been examined. Finally comparative advantages of IWT to compliments other modes of transport as well as a logistical approach of overcoming the drawbacks it possesses like slow steaming, additional warehousing and additional handling costs.

2. Port Development and the Hinterland Connectivity

The development of port has been influenced by different indicators like growth in global trade, changes in trade pattern, logistic thinking as well as expanded hinterland of ports (Alderton, 2008). The development of inland transport system has contributed largely to develop port as a logistics centre and serve comparatively larger hinterland. The specialization stage of port evolution theory by Bert in 1980 (Bichou, 2009) as well as (UNCTAD, 1992) defined third generation port strongly supports the distribution of cargo towards landside as a prime indicator of port development. A further discussion by (Notteboom and Rodrigue, 2005) in describing the fourth generation port named regionalization depicts port as an inland distribution centre favoring transport corridors and logistic poles serving very large hinterlands becomes foremost importance in port competition. The hinterland and foreland of a port complement each other generating cargo in both ways from import and export (Garcia-Alonso and Sanchez-Soriano, 2009). The development of global logistic chain is the facilitation of port infrastructure as well as hinterland connection (OECD/ITF, 2009). The importance of hinterland connection parallel to port development has duly been discussed in the report entitled 'hinterland connections of seaports' by the expert group of UNECE

(UNECE, 2010). Different ports competing for the same inland area the hinterland connection is becoming more important for the port authorities. In the same report in choosing the alternative modes of connecting the port hinterland emphasis has been given to rail and inland waterways due to their competency in transporting large volume which make them both cost and environment effective. The availability and performance of inland connection is considered as one of the key criteria in choosing deep sea port by the container shipping lines (Wiegman et al., 2008). Therefore, more and more giant shipping line in parallel to integrating in port operation now started to integrate inland freight operation as well (Cariou, 2008). The landside integration of port may enable the port get competitive advantage in multilevel including diversification in port service portfolio, redirect port investment leading employment generation and regional development, competitive advantage over neighboring ports and integration to the logistic and transport chain offering a central role in the international and logistic distribution system (UNCTAD, 2004). However, the operational, management as well as legal aspect of inland transportation is quite different from the port as well as sea transport.

The hinterland connectivity is comprises of different modes of transportation bearing different characteristics, however the choice completely depends on cost, time as well as safety. The cost efficiency of inland waterways is associated with the ability of carrying large quantity of cargo at a time. On the other hand slow steaming as well as the lack of door-to-door facilities nature of inland waterways hindrance the users to choose other modes predominantly road. Among others, waterway transportation is being considered as the safest and environment friendly mode. Despite such advantageous position waterway transportation could not manage to attract adequate portion of share even in the developed part of the world (Merk and Notteboom, 2015). Analyzing the three waterways in Europe including Danube, Elbe-Vltava and Vistula, it has been identified that the inadequate port facilities, lack of awareness of main stack holder, medium distance, unreliability, unsatisfactory navigation condition and government policy are some of the prime challenges there (INWAPPO project, 2014).

3. International Maritime Trade in Bangladesh

The growing international trade in Bangladesh impacted largely in the maritime activity of the country. With a growth rate of international trade of around 13.9% for the last decade (ADB, 2011), the maritime ports of the country has shown remarkable growth in freight handling. Even though there are two maritime ports situated in Chittagong and Mongla, however, the Chittagong port works as the gate of the country. Almost 95% of the maritime trade of the country is handled through Chittagong port (CPA, 2016). The port has achieved the 2.0 million TEUs handling mark by this time. The total tonnage handled in the year of 2014-15 by this port is almost 62 million tons (CPA, 2016). The traffic scenario of these two sea ports are being presented below:

The cargo pattern handled in the CPA is a mix of dry bulk, containers and liquid bulk. The major import items includes

Table 1: Comparative performance of the maritime ports

Year	Chittagong Port Authority (CPA)		Mongla Port Authority (MPA)	
	Cargo MT	Containers	Cargo MT	Containers
2010-11	50,199,359	1,468,914	1,649,283	27,123
2011-12	48,021,950	1,343,408	2,619,897	30,045
2012-13	49,917,174	1,468,713	3,147,574	43,873
2013-14	53,577,551	1,625,509	3,543,949	43,007
2014-15	61,725,865	1,867,062	4,530,279	42,137

Source: (CPA, 2016; MPA, 2016)

clinker 32%, POL 13%, food grains 5%, fertilizer 3% and sugar 5% whereas the major export items includes ready-made garments 50%, jute & jute goods 18% and frozen food 3% (CPA Annual Report, 2013-14). Greater Dhaka is the main hinterland for both the port. Almost 70% of the cargo handled at both this port is origin and destined to the Dhaka region. Among other the rest cargo distribution scenario is like 20% in Chittagong region and 10% in Khulna region and the rest of the country (ADB, 2011).

There are two more maritime ports under consideration of establishment which are Payra port and Sonadia deep sea port. The construction of these two ports would obviously enhance the maritime traffic leading towards the necessity of more developed hinterland infrastructure.

4. Hinterland Connectivity and the Performance of Modes

Between these two seaports CPA has better connectivity through all modes of transport, whereas the MPA has connectivity through inland waterway and road only. However, the road connection is subject to a ferry crossing on the mighty river Padma and the inland waterway also faces tremendous navigability problems. The construction of bridge on Padma, which is under construction (BBA, 2016), would connect the port through both road and rail to the main hinterland of the country, Dhaka.

The cargo handled in the Chittagong port of which almost 90% of the containers are transported by road. There is one ICD at Dhaka connected via rail which handled around 5-7% of the containers. Moreover, there are two inland river container terminals in operation handled one by the government agency and another by the private enterprise has managed to handle some number of containers which are still negligible because of regular and reliable service (Rahman and Hasan, 2015). However, the bulk commodities handled in the maritime port are mostly transported through inland waterways. The CPA annual report (2013-14) shows that the bulk commodity handled in the port of Chittagong whose 61% have been transported by waterways, 38% by road and only 1% by rail. However, the overall share of cargo transportation by different modes in Bangladesh which bit old but only available information shows that 80% of it is transported by road, 16% by inland waterways and only 4% by rail, represents the dominant presents of road as connecting the hinterland from different maritime ports and growth centres as well (The World Bank, 2007).

5. The River System and the Inland Waterways Transportation

There are about 24,000 km of waterways in Bangladesh that cover about 7% of the country's surface. Most part of the country is linked by a complex network of waterways which reaches its extensive size in the monsoon period. Out of these 24,000 km of rivers, streams and canals only about 5,968 km is navigable by mechanized vessels during monsoon period which shrinks to about 3,865 km during dry period. They are of varying nature and have differing hydraulic characteristics. For convenience, the rivers are grouped in four separate divisions, which are the braided rivers, the tributaries, the distributaries and the tidal rivers.

The very large rivers of Bangladesh like the Ganges, the Jamuna, the Padma and the lower Meghna fall in the category named the braided. In the monsoon seasons or the high water periods their discharges cover the entire river bed, often overtopping the banks and flooding adjacent areas. In the winter seasons or the low water periods, the reduced discharges cause the river to bifurcate into a number of branches that meander within the high water banks. Rivers like the Surma, the Barak and the Atrai perform the task of collecting the discharges from the local catchments and feed the main rivers. These generally fall in the 'meandering river' category and named as the tributaries. On the other hand the rivers branching out from larger rivers e.g. the Lakhya and the Arial Khan river which water levels depend upon the discharges received from the main rivers have named the distributaries. Generally their confluences at the offshoots and outfalls are problematic for navigation due to silt deposition and formation of shoals caused due to transitional changes in cross-sections. The last group of rivers named as the tidal rivers are located mostly in the southern part of the country and is dominantly tidal in character. Examples are the Pussur, the Karnaphuli, etc. Generally speaking, the waterways of Bangladesh display a high water and a low water flow period. The low water period usually takes place from November to April every year, the lowest water levels usually occurring in the months of February-March. During this time not only water levels fall but also shoals appear in the channels restricting smooth navigation. The classification of the waterways according to their navigability is also associated with the nature and characteristics they are bearing. The very large rivers fall into class I and Class II having a least available draft (LAD) of respectively 3.6 meter and 2.1 meter. All the operating and proposed maritime ports have connectivity to main hinterland

Table 2: Modal Share of Three Modes in Total Transport Sector

	Passenger Traffic (Billion Pass.-Km)							Cargo Traffic (Billion Ton.-Km)						
	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	37%
1996	66	52	79%	3.9	6%	10.1	15%	10.7	6.9	63%	0.8	7%	3	30%
96/05 annual growth	7.1	6.6	-	0.7	-	-1.3%	-	6.9%	8.6%	-	0.8%	-	0.1%	-
2005	111.5	98.4	88%	4.2	4%	8.9	8%	19.6	15.7	80%	0.8	4%	3	16%

Source: Revival of Inland Water Transport: Options and Strategies, 2007

through inland waterways. Therefore, inland waterways could become the main modes of hinterland connectivity surpassing road very firmly. Despite such an advantageous position along with the navigability problem the inland waterways also suffers from the poor management and operation.

The two operating maritime ports that is the Chittagong and Mongla are connected to the main hinterland that is greater Dhaka through a category of class I inland waterways, however, due to poor maintenance there are various problematic zoon that hindrance the smooth transportation of the inland vessels. Moreover, in lack of night navigation facilities in all through the way, 24 hours navigation is also hamper. The vessels operating the waterway connecting Dhaka-Chittagong needs to depend on high water to cross a certain portion of the route call Sandwip Channel (BIWTA, 2016) whereas the vessel operating the Dhaka-Mongla waterway needs to operate an alternative longer route due to the navigability problem in a man-made canal name MG (Mongla-Ghasiakhali) canal. However, it has been identified that the maintenance of this small portion of the whole route is economically viable than using the alternative longer route (Hasan et al., 2015).

The port infrastructure is also not up to the mart. Poor infrastructure, operational inefficiency, location of port facilities in the congested city centre impedes the small shippers to use the inland waterways. Mostly the industrial shippers who have developed their dedicated jetties use the inland waterways to transport their large volume raw materials from the maritime ports. They are basically the significant contributors of the greater volume of bulk freight transportation to the hinterland through inland waterways. Besides the dedicated jetty most of them own their own fleet, which facilitate them a comparative advantageous position of minimizing time consumption as well as cost reduction. The container transportation is hampered here due to the availability and reliability of liner services (Rahman and Hasan, 2015).

6. Role to Play by IWT

Inland waterways can play a pivotal role in the hinterland connectivity of the maritime ports. The accessibility of the waterways network is large enough to cover all the growth centre of the country. What is the lack is of a proper operational planning to utilize this in an economic and efficient way. According to (The World Bank, 2007), More than fifty percent of the economic activities in the country are located within a distance of

10 km from the nearest navigable waterways in all seasons. The high degree of penetration of the IWT network is providing access to about 25% of the rural household in Bangladesh. This is also the main mode of transport in the north eastern haor areas and south coastal areas where the road network is less developed. Inland waterway has a overall cost advantage over other modes as well. It has been estimated that it costs Tk. 1.00 for IWT, Tk. 4.5 for road and Tk. 2.5 for rail to transport per ton cargo per km. The use of IWT could save about 58.5 million liters of diesel and 155,000 tons of CO_2 per year (The World Bank, 2007). However, this advantageous position of inland waterways do not represent the role what it should play. Even the previous section shows the performance of the sector is deteriorating gradually. Among others the poor maintenance of navigability has been considered as the prime reason of such deterioration. Since the transport sector of the country is subsidies by the government, poor budgetary allocation compare to other modes leaded towards the inefficient utilization of this prospective sector. The following figure provides the sector allocation of development budget.

However, if the percentage of budgetary allocation is considered with the performance of the sector the results reflect much better return on investment for inland waterways, but still the sector failed to attract the attention of both public and private sector.

The untapped opportunity of inland waterways could better be attained by analyzing its strength as well as opportunities some of which has already been identified in the previous discussion.

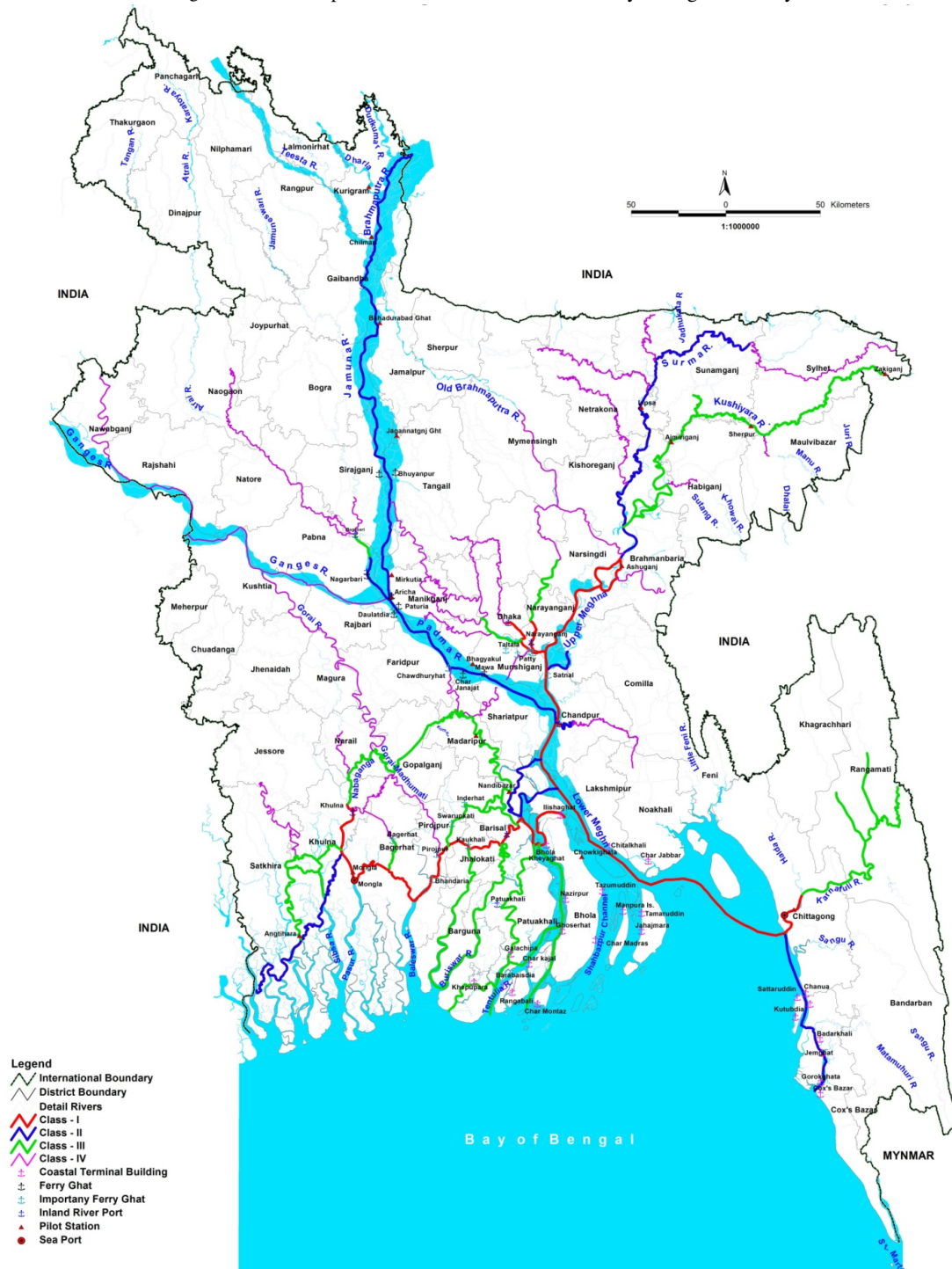
Table 3: Modal Share of Three Modes in Total Transport Sector

Strengths	Weaknesses
Larger connectivity including the connectivity to the main hinterland with Class I depth	Overall navigability problem but only some certain portions of main corridor
Cheap, safe and environment friendly	Low speed
Less maintenance cost	Very poor government allocation
Experience of handling the bulk commodities from maritime ports	Limited infrastructure and poor operation
Limited but infrastructure for handling containers are there	Unawareness of users and stack holders

Source: Revival of Inland Water Transport: Options and Strategies, 2007

If the above strengths and weaknesses are analyzed parallel, the logistic solution for better utilization of waterways diverting more and more cargo freight to this is not a difficult scenario to

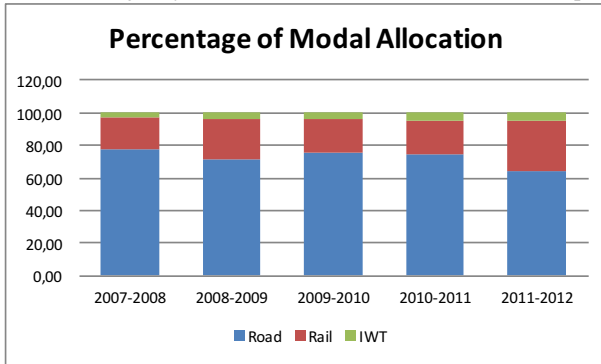
Figure 1: Maritime ports & their hinterland connectivity through waterways



develop. A holistic approach to overcome the weaknesses utilizing the strength would be very significant step for a cheap, safe and environment friendly hinterland connectivity modes development. The best approach would be to advance on a corridor development mechanism covering the main two corridors that connects the maritime ports with the main hinterland including all allied facilities. That would also include the further facilitation of industrial development along the corridor. And

to do this channel navigation is the priority concern where the port infrastructure modernization would add value. Developing awareness of the stakeholders in the light of social responsibility by promoting the usefulness of waterways, that pays more to society and environment and facilitating a door-to-door mechanism and operation of reliable, frequent and regular container services. The under utilization of the current facilities could be better be optimize by transporting empty containers which

Figure 2: Budgetary Allocation for Different Modes of Transport



Source: Compiled data from (BIWTA, 2016)

might not need a regular services. If reliability and regularity be established for the container services a significant portion of diverse could be expected as the shippers could be able to design their supply chain more accurately. And this would establish the waterways as the major modes of transportation as it is already transporting the largest share of bulk commodity from the maritime port Chittagong.

Integration in the operational and management aspect would create more value even though it is quite difficult to implement. In this case the Chittagong port could play a vital role, as the agency has god financial strength and experience of operating ICD's both through rail and inland waterways.

7. Conclusion

The inland connectivity in Bangladesh similar to other countries is largely dependent on the road sector. Even though there is a bright area of transporting the bulk commodity from the main maritime ports to the main hinterland through waterways however, still far from the prospects. Having a greatest spread and connectivity, inland waterways could contribute the most cost effective, environment friendly and safe modes of transport. Being a highly populated densely country and one of the largest deltas of the world it would be much economical as well as logical to meet the ever growing transport demand of the country by diverting more and more of its commodity movement to inland waterways. Hinterland connectivity is a significant part of port operation and management today. Among different modes of transportation connecting the main maritime port to the main hinterland inland waterways could be the main solution here and the best way would be the development of corridor to connect the main maritime port to the main hinterland. Here, the Chittagong port authority could play a vital role by integrating the inland waterways in distributing the commodities

to the main hinterlands of the country from both the operational and management aspect.

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