

# Key Issues/Challenges for Inland Water Transportation Network in India

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## Abstract

The authors explore transport and trade as two broad service sectors of inland water resources. An attempt is made to find out the key issues and challenges from this sector with the evolving understanding of Indian inland water transportation system. The paper explains the background of inland water transport sector in India along with the discussion of issues and challenges faced by the same. The authors state that co-operation and co-ordination between inter-state governments is a strategic element to expand the network of inland water transport system in India beyond state boundaries. Conclusively, the prospect of inland navigation looks promising, wherein issues on infrastructural gaps and institutional support are addressed suitably.

**Keywords:** Inland Water, Navigation, Transportation, National Waterways

## 1. Introduction

India has an extensive network of rivers, lakes and canals, which, if developed for shipping and navigation, can provide resourceful inland connectivity. India has approximately 14500 km of navigable waterways. At present Inland Waterway Transport forms a very diminutive part of the total transport network. Inland waterways are historically recognized as vital arteries for communication and transport especially for the rural people [1]. In the 19<sup>th</sup> century and first half of 20<sup>th</sup> century, inland water transport was an important mode of transport – navigation by power crafts and country boats played significant role in development of trade and commerce along several rivers and canals including deep hinterlands of Ganga and Brahmaputra. With spread of globalization and the advent of railways and extension of rail network affected inland water transport in India. Rapid growth of roads, coupled with inadequate development of inland water transport sector over the years gave a decisive set back. This transformation left the inland waterways as a neglected sector. Until today, rivers in urban centers and rural areas of developing countries constitute of small, non-mechanized country boats often used for transport, trading and livelihoods. One often refers to the populations along waterways as half-amphibious for the reason that a water body is centric to their way of life and to the economy of their

household. The inland water transport sector became totally marginalized except in a few areas namely Assam, Goa, Kerala, Mumbai, West Bengal and some creeks in coastal areas where it has natural advantages. In order to regulate inland waterways in India, Government of India instituted Inland Waterways Authority of India (IWAI). The organization got functional in 1986 with a mandate to facilitate the commercial and non-commercial use of channel systems. Operational zones referred as National Waterways restrict to national jurisdiction with defined emphasis on shipping and navigation. The Figure 1 show Indian waterways.



Figure 1 Major Waterways in India

## 2. Navigable Waterways in India

India ranks in 9<sup>th</sup> in the world in terms of potential navigable waterways (source: the world fact book 2008) Length of waterways along with its navigable length is an indicator of inland water potential of a state. Figure 2.1 gives the Navigable length of Waterways reported across States/UTs. It is observed

that the maximum length of waterways is in the State of Assam followed by West Bengal. However, the ratio of the navigable length to the total length of the river/canal better reflects the potential for Inland water transport. As per the available data presented in Figure 2.1, it is observed that the ratio of navigable length to the total length is about 97% in the State of West Bengal, by contrast, in case of Gujarat the ratio of navigable length to total length is a mere 15.62%. Other States with good inland water transport prospects are Goa, Maharashtra, and Bihar where waterways navigable length is 90.84, 73.22 and 62.4% respectively of the total length of rivers/lands/lakes reported by these states. Fourteen states have reported river length as well as navigable length for 137 rivers. These 137 rivers have total length of 28511 Km of which 45.83% is navigable length. Some of the important source of waterways, rivers and canals in India are as follows

- River Ganga
- River Brahmaputra
- Backwaters of Kerala
- Goa Waterways
- Mumbai Waterways
- River Tapi
- DVC Canal
- National Waterways

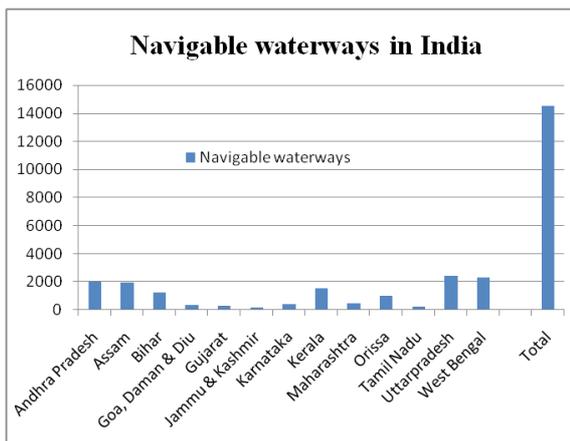


Figure 2.1 State wise Navigable Waterways

### 3. Operations & Developments In Inland Watertransport System

The inland waterways authority of India was constituted by an act of parliament for development and regulation of inland waterways and issues concerned thereto. As per the constitution provisions only those waterways which are declared as national waterways comes under the purview of the authority while rest of the waterways remains the domain of the respective state governments. As of now there are following list of National Waterways in India.

No	Stretch	Length
1	River Ganga Haldia to Allahabad	1620Km
2	River Brahmaputra From Dhubri to sadiya	891Km
3	West Coast Canal From Kottapuram to Kollam with Udyogamandal and champakara canal	205Km

4	Kakkinada-Puducherry stretch of canals with river Godavari and river Krishna	1078 Km
5	East Coast Canal with river Brahmani and river Mahanadi's delta	588Km
6	Barak River Lakhipur to Bhanga (on Process)	121Km

Table 3.1 National Waterways

### 3.1 Cargo Movement

Cargo transportation by inland water transport in India has been steadily increasing. Movement of National waterways I, II and III has increased from 3MMT in 2005-06 to 7.1MMT in 2015-16, an overall growth around 137 percent. The following tables provide cargo statistics of National Waterways.

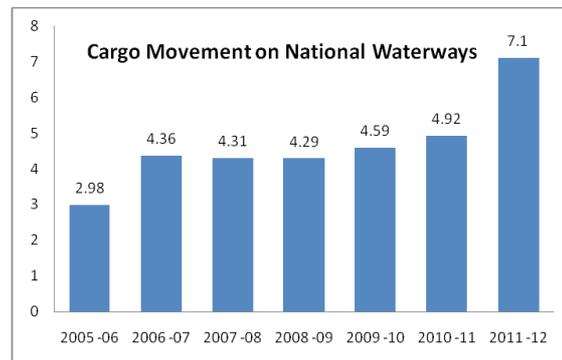


Figure 3.1 Cargo Movements on Waterways

### 3.2 Passenger Movement

In India, the main passenger movements by inland waterways that 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).

### 3.3 Projects Related to Waterways

Government of India had identified 101 new waterways for the proposal for declaration as new national waterways in the country. Construction of New Terminals and Fairways across the National Waterways, Capacity augmentation of navigational infrastructure of National Waterways I, Kaladan Multi Modal Project, Indo – Bangladesh Protocol Integrated National Inland Waterways Transportation Grid etc. In India, Rail and road accounts for 25% and 60% respectively whereas the modal share of inland water transport system is merely around 0.40% over other transport modes in India.

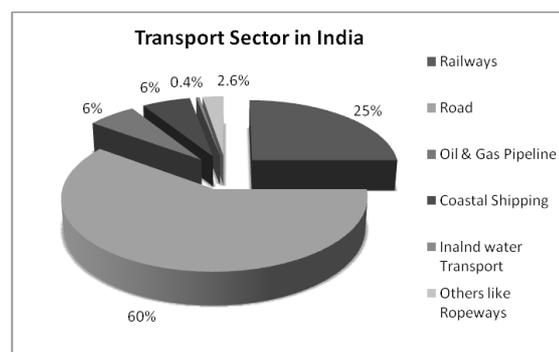


Figure 3.2 Modal Share of Transport Sector

#### 4. Challenges / Key Issues

India's inland water transport sector is relatively under developed compared to other large economies due to matrix of natural reasons and policy lacunae. The general Key issues or challenges in inland water transport sector are classified as Technical, Regulatory, Geo-Political, Financial and Integrated Development Approach issues are faced by inland water transport sector in India.



##### 4.1 Technical Challenges

Absence of adequate navigation infrastructure is one of the biggest challenges faced by this sector

- a) **Inadequate depth:** Large parts of Indian waterways have inadequate depth for commercial movement of cargo. Sufficient depth or least available depth is required to enable navigability of larger vessels, essentials to make inland water transport system as commercial viable through economies of scale. Moreover indian rivers (especially in the northern plains) face severe problems of siltation round the year. The river bed rises, impeding movement of cargo during non-monsoon months.
- b) **Inadequate air draft:** Multiple bridges with low vertical clearance obstruct the passage of bigger inland water transport vessels on waterways such as National waterways No.3. There several navigable canals in the states of Uttar Pradesh, Bihar, West Bengal, Tamil Nadu and Andhra Pradesh: Sarada canal, Ganga Canal, Yamuna Canal, the delta canal systems of the Krishna, Godavari, Mahanadi and Brahmani. But these cannot be utilised for cargo movement due to air draft restriction.
- c) **Shortage of IWT Vessels:** Vessel buildings is highly capital intensive and faces difficulties in obtaining project finance from banks and financial institutions. The private sector is reluctant to invest in barges unless long term cargo commitments for onward/return trips are made from user industries.
- d) **Lack of Terminals:** Including those with inter-modal connectivity on inland waterways inhibit door to door connectivity to end user.
- e) **Lack of night navigation infrastructures:** Lack of Night navigation facilities such as DGPS and RIS. Non availability of waterway channel round the year coupled

with rudimentary infrastructure with night navigational facilities and markings are also one of the major impediments in the successful operations in waterways.

- f) **Shortage of MRO Facilities:** there is a severe shortage of MRO (Maintenance, Repair and overhaul) facilities for inland water transport vessels.
- g) **Integration:** Integration of river basins to ensure year round navigability: strategy to mitigate seasonality of water availability & siltation

##### 4.2 Regulatory Challenges

a) **Modal Integration:** and Related infrastructures development. Lack of potential multimodal corridors and detailed mapping of waterways and industrial clusters, multimodal transport hubs in inland water transport corridor. There is need to develop a feeder routes on the waterways under the jurisdiction of state to national waterways so that the entire channel can be developed on the "fish bone structure". As well as need to integrate the inland water transport with coastal shipping operations in order to integrate and accommodate hinterland coastal and international maritime traffic.

b) **Operation and Maintenance:** of fairways and related infrastructure for private participation to achieve accelerated development. Needs to implement the river information systems on waterways.

c) **Policy parity:** The government needs to establish a level playing field between the various transport modes. While inland water transport is cost competitive in general with other transport modes such as rail and road, the situation is sometimes, distorted by preferential treatment offered to other modes. An example is freight transportation for fertiliser being extended to rail and road but not to inland water transport. This artificially makes rail and road more competitive on the cost curve and drives traffic away from inland water transport road and rail also enjoy preferential tax treatment.

Mode	Freight (Rs/TKm)	Effective Taxes	Total Rs/TKm
Railways	1.36	3.71%	1.41
Highways	2.50	3.09%	2.58
Waterways	1.06	Nil	1.06

Table 4.1 Intermodal Comparative operating Costs Rs/TKm

- d) **Legal and Administrative issues:** since the navigable inland waterways invariably run through more than one state, it is important to have uniformity in the realm of various operational aspects of inland water transport throughout the country. The model inland vessels rules also needs to have the uniformity for followed up by adoption of various states.
- e) **Restructuring:** of inland waterways authority for further efficient operations of development maintenance and regulation of fairways and navigational infrastructure, effective utilisation of fairways.

##### 4.3 Geo Political Challenges

a) **International Protocols:** An international protocols route are providing the direct linkage of Haldia and Kolkata ports with landlocked north-eastern states and has potential to be utilized as main mode for transportation of cargo from north eastern region to Kolkata and Haldia besides enhancing trade

with Bangladesh. Energy efficiency of waterway gets negated by the higher turnaround time of the barges due to the administrative and operational delays along protocol route.

b) **Cross Structures:** Construction of dams/barrages to increase depth of navigational channel faces challenges of economic viability. The multipurpose hydro projects planned for the long term perspectives are needed to ensure the interest of navigation.

c) **Inter Linking of Rivers:** the river inter-linking projects are ensuring to use as waterways for navigation. The Inland water transport has a strategic importance for connectivity of north eastern regions which do not have very efficient connectivity due to its geographical position and rail/road transport passing through the 'chicken neck'.

#### 4.4 Financial Challenges

a) **Investments by Governments:** There has been under investment in inland water transport sector infrastructure vis-a-vis road and rail. While considerable emphasis has been laid on development of road and rail infrastructure in successive five years plans, inland water transport sector has been neglected. Consequently, public investments in inland water transport mode have been far below the levels attained by other modes.

b) **Investments by Private:** As a policy measure the possibility of private sector participation for the development, maintenance and regulation of some stretches of the inland waterways can be explored similar to other transport sector like road and metro rail.

c) **Capacity building:** There is huge demand for trained manpower for vessel operations as well as for development and management of inland water transport infrastructure since the limited resource in training and research & development for inland water transport there is need of potential investment in training and research.

#### 4.5 Challenges in Integrated Project Developments

a) **Long Term Cargo Commitment:** There will be the shortage in long term cargo commitment for economic stability of sustainable operations in the waterways.

b) **Viability Gap Funding:** the stakeholder agencies may identify some cargo for specific composite projects and develop them jointly with shippers and other stakeholders. The government should be willing to provide the necessary viability gap fund or fund from normal budget for developing the missing infrastructures.

c) **Modal Shift Incentives:** even in the countries where inland water transport sector is developed, proactive actions are being taken by the governments to promote waterways since they have strengths which are beneficial to the economy as well as environment.

d) **Factors affecting the diversion of waterways Traffic:**

- Type of commodity
- Volumes to be handled
- Actual place of origin /destination
- Long Term Commitment of Traffic
- Distance from terminal
- Existing Modal Choice (Rail/Road)

- Port – Waterways Connectivity
- Comparative Inter modal distance
- Water Transport Trip (O-D) Distance
- Empty Return Ratio
- No. of users at the terminal (captive or multipurpose)
- Deep sea transshipment, wherever feasible

### 5. Major Considerations For Inland Waterways In India

As is to be expected, the major considerations for the use of inland waterways, rather than other forms of transportation, often vary from state to state, depending on economic, technical, social and political considerations. While certain considerations like Fuel efficiency, cost-effectiveness or technical feasibility, low green house gas emission, low development costs, decongestion, ideal for transportation of hazardous/dangerous cargo, all weather mode, requires minimal land acquisition are universal, the priorities accorded to these factors, compared to other factors, could vary from one country to another, and also from one time period to another. In contrast, other considerations like employment potential often have different policy implications, depending on the state concerned. There are many major considerations for using inland waterways, and some of these issues are interrelated. Because of space limitations, only the following five major considerations will be briefly discussed here:

- Economic efficiency
- Employment potential
- Energy use
- Environmental factors and
- Socioeconomic requirements.

#### 5.1 Economic efficiency

It is a difficult task to determine the economic efficiency of any process, and inland waterways transportation is no exception. Three factors need to be considered for determining total costs - capital, labour and operating expenses - which, when combined, forms an operating system. The productivity of a system, however, depends on the system used, the extent of mechanization, the use of the latest technology and overall management. In India the analyses carried out by the National Transport development Policy Committee of the Government indicate that the cost of operation of inland waterways transportation, computed for a 500-tonne self-propelled unit working at 75% load factor working for 300 days a year, is significantly lower than rail and road transportation of bulk products like coal and fertilizer.

Parameters	Water ways	Rail	Road
Energy Efficiency 1 HP Can move what weight of Cargo in (Kg)	4000	500	150
Fuel Efficiency 1 Litre of Fuel can move how much freight (ton-km)	105	85	24
Equivalent Single unit carrying capacity	1 Barge	15 Rail Wagons	60 Trucks
Air Pollution	Low	Medium	High
Land Acquisition	Low	High	High
Capital Required	Low	High	High

**Table 5.1 Comparison of Inter Modes**

The cost advantages of Inland Water Transportation become even more favourable when larger-size vessels are used. For example, for a 1500- tonne vessel operating costs are less than half of the rail transportation costs and less than one third of the road transportation costs. Inter comparison of actual transportation costs by different modes of transportation is not easy under the best of circumstances, because of the different processes involved, the nature of government policies towards different modes of transportation, pricing policies and subsidies. own and operate their tracks.

**5.2 Employment potential**

India facing serious unemployment and underemployment problems, the objective of employment creation is often an important component of the national transportation policy. However, maximization of employment generation is seldom the most important criterion for determining transportation modes. The sole use of the employment maximization criterion could very often lead to a transportation mode which is most labour-intensive per unit of investment but inefficient in terms of cost, time and service. Hence, in an interdependent economy, where transportation plays a crucial part, such an inefficient transport system could well jeopardize the overall employment level of the country by its failure to provide a cost-effective and timely service. Direct employment is created by the construction, operation and maintenance of the transportation system. Indirect employment is induced by a chain of forward and backward linkages. The National Transport development Policy Committee estimated employment intensity of Inland Water Transportation for India; In addition to the 33.59 person years of employment indicated in the table 5.2, it was estimated that another 13.2 person-years of employment were generated for the construction and maintenance of navigational channel and terminal facilities per Rs 100 000 of investment. Analysis by the Indian National Transport Policy Committee indicated that Inland Water Transport system provided a higher employment coefficient per unit of investment than any other mode of transportation.

Activity	Persons Employed per Rs 100 000 of Investment
<b>Passenger Transport</b>	
Public Sector Mechanized	9.2
Private Sector Mechanized	9.2
Country Crafts	58.8
<b>Freight Transport</b>	
Mechanized	1.4
Non-Mechanized	20.8
<b>Boat Building</b>	
Mechanized	14.8
Non Mechanized	NA
<b>Indirect Employment</b>	160
<b>Overall Average</b>	33.59

**Table 5.2 Estimated Employment Intensity**

**5.3 Energy use**

Energy use by different modes of transportation has become an important criterion since 1972. Not only is the cost of energy used an issue but also the problem of the impact of imports of energy material on a country's balance of payments has equally become important, especially for oil-importing developing countries. As far as transportation of bulk products is concerned, Inland Water transportation is comparable more with railways and pipelines, since the uses of air cargo and roadways are not that relevant. The analyses carried out by the National Institute of Training in Industrial Engineering (NITIE) for the National Transport development Policy Committee (1980) show somewhat different results for India, as indicated in Table. According to that study, electric traction railways came out as the most energy-efficient form of freight transportation, followed by diesel traction railways, Pipeline, Inland Water Transport system, diesel truck and steam traction railways. Since not all the assumptions of this analysis are clearly stipulated, Whereas the energy consumption for river transport in China was estimated at 12 g/tonne-km compared to 68 g/tonne-km for road transport (ESCAP, 1982a).

Transportation Mode	BTU/Tonne-Km
Railways	
Electric	84.6
Diesel	255.5
Steam	3576.9
Diesel Truck	1587.3
Barge	328
Pipeline	281.7

**Table 5.3 Comparison of Energy Efficiency of Different Modes of Freight Transport**

**5.4 Environmental factors**

Environmental factors have become important issues for transportation policies in both developed and developing countries. In many ways Inland Water Transport system has important environmental advantages over other modes of transportation. In the important area of land use, requirements for Inland Water Transport are minimal since, in contrast to railways and highways, no additional land is necessary for tracks and roads because waterways already exist. Similarly, noise and vibrations are almost non-existent for Waterways, but they are important considerations for other forms of transport, except for pipelines. Pipelines in certain Instances have contributed to difficulties in terms of the migration of animals and also for aesthetic reasons. Probably the most important environmental considerations for Inland Waterways are the problem of oil spills and spills of hazardous substances. The Safe disposal of dredging spoils and aquatic weeds seldom presents a serious problem, if planned properly. This, however, does not mean these problems should be neglected. The Maintenance dredging and capital dredging are carried out annually in India however, no serious environmental problem has been reported so far. Inland Waterways does not appear to have any noticeable impact on wildlife, including waterfalls.

**5.5 Socio Economic requirements**

There are some important socioeconomic requirements, in addition to those discussed earlier, for Inland Waterways. In countries like India, where most of the people live in rural areas, transportation is an important consideration for development. For example, as the National Transport Policy Committee (1980) has pointed out, out of a total of 575 936 villages in India, 407 297 are still to be connected by all-weather roads. For many of these villages, Inland Waterways is an important mode of transport.

## 6. Suggestions/Recommendations

- Integration of coastal shipping with Inland water Transport
- Actively Supporting Self-employed Water
- Actively Developing Economic Alliances in Inland Water Transport
- Allowing Private participation in maintenance of waterways
- Reviving the subsidy plan
- Encouraging Multi-Modal transport

## 7. Conclusion

In the above study the key issues or challenges and advantages of Inland waterways over other modes and the crisis that it is facing in India has been reviewed. An analysis of the global situation with respect to Inland waterways Transport system in India clearly indicates the great variations in their importance and use from others. While geographical conditions can explain this anomaly to a certain extent, lack of realization of the potential impact of Inland water Transport System on national economies continues to be an important factor. On a global basis, expansion of waterways in developing countries has more potential than in developed countries, where this mode of transportation is more mature. The Inland Waterways also showed favourable advantages over road or rail transport existing in the country. The analysis of coastal cargo movements in India shows that the utilization of Inland waterways in India is minuscule compared to European Union or neighbouring countries like China. It gives a clear picture of inefficient handling of Indian ports which not only discourages the Inland Water Transport but also the whole maritime trade. Coping up with these factors will require a humungous amount of effort from both the government and the private sector. Private investment is necessary in this sector to ensure more funds and more participation by making the most of the Inland Waterways. This sector will best function and develop if kept open for private investment. Due to the opening up of the Indian economy and its fast growth GDP, there has been an urgent need for efficient transport system in a large scale for movement of bulk goods for providing the infrastructure to the power sector, distribution of food grain, fertilizers, construction material, Petroleum, oil and Lubricants, Over-Dimensional Consignments, etc. Rail and Road, modes are already overburdened, and congested. Their expansion requires huge capital investment, time, a lot of land acquisition making it very often a difficult proposition. Hence, a need has arisen for the development as well as integration of both coastal shipping and inland water transport. There is potential for integration of coastal shipping with Inland water Transport and thereby to enhance its share in the total transport system of the country. The seamless integration of the coastal shipping and inland water transport can be effective only when the vessels can operate in both the sectors economically. The availability of inadequate water depth in the inland waterways may have

certain disadvantages for design and construction for an optimum designed vessel. Without a National Water Transportation Policy, Development of Inland Waterways can proceed only on an ad hoc, piecemeal basis.

## 8. References

- [1] Rangaraj, N. and G. Raghuram (2007) "Viability of Inland Water Transport in India". ADB-India Resident Mission: INRM Policy Brief No-13:
- [2] Biswas, A. K., O. Unver and C. Tortajada (Eds) (2004) "Water as a Focus for Regional Development". Oxford University Press, Delhi. Directorate General of Shipping (2009) "Annual Report [2009-10]", Government of India. India.
- [3] Eastman, S. E. (1980) "Fuel Efficiency in Freight Transportation" The American Waterway Operators, Inc. Arlington, VA, June, 7.
- [4] Inland Waterways Authority of India (2008) "Annual Report [2008-2009]"-Published by Department of Shipping-Ministry of Shipping, Road Transport and Highways. Noida-India, pp.
- [5] Inland Waterways Authority of India (2011) Report of the sub Group VIII, (Inland Water Transport) of the working group on Ports and Shipping Under National Transport Development Policy Committee.
- [6] Koetse, M. J. and P. Rietveld, (2009) "The impact of climate change and weather on transport: An overview of empirical findings" Transportation Research Part D.
- [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] Nair, R. M. (2005) "Inland water transport-Policy support must go full steam". The Hindu (Business Line). Monday, Aug 15.
- [11] National Council of Applied Economic Research (NCAER) (2006) "Economic Yield and Feasibility of the Inland Waterways Mode of Cargo". Quarterly Newsletter. New Delhi, India. Connexions,
- [12] Nationalization of Inland waterways (2011), Central Public Policy Research
- [13] Planning Commission, 2011. Report of the Working Group on Inland Water Transport, Sr. No 9/2001, New Delhi.
- [14] Ahmad, Q. K., A. K., Biswas, R. Rangachari and M. M. Sainju (2001) "Ganges-Brahmaputra-Meghna Region: A Framework for Sustainable Development", The University Press, Dhaka.
- [15] Rahaman, M. M. (2009) "Principles of Transboundary Water Resources Management and Ganges Treaties: An Analysis". Water Resources Development, 25(1)
- [16] Sriraman S, 1998. Inland Water Transport in India: Issues and Prospects, Asian Transport Journal, Asian

- Institute of Transport Development, New Delhi, June 1998.
- [17] Sriraman (2010) "Long term perspectives on Inland Water transport in India" RITES Journal,
- [18] Statistics of Inland Water Transport 2011-12, Transport Research Wing, Ministry of Shipping, Government of India, New Delhi
- [19] UNCTAD [United Nations Conference on Trade and Development] (2009) "Review of the Maritime Transport -2009". Chapter 5. United Nations (UN) - New York and Geneva
- [20] UNEP (2011) "Low Carbon Transport in India"- Stakeholders' Consultation Workshop: 18-20 October 2011, India Habitat Centre, New Delhi, India
- [21] UNEP (2011) "Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers"
- [22] Verghese, B. G. (2006) "Water resources in the northeast: Development options in a Cooperative Framework" Background Paper, Centre for Policy Research,
- [23] WB, 2005. China Inland Waterway Project World Bank