Students’ Edition of BRINICLE in Collaboration with IIRE JOURNAL of MARITIME RESEARCH & DEVELOPMENT (IJMRD)

ISF Institute of Research and Education (IIRE)

MARCH 2019
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Maritime sector has always been influencing the global economy. Shipping facilitates
the bulk transportation of raw material, oil and gas products, food and manufactured
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be said that without shipping, the intercontinental trade of commodities would come to
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ABOUT INDIAN MARITIME UNIVERSITY – MUMBAI PORT CAMPUS

Indian Maritime University – Mumbai Port Campus comprises of two premier institutes, Lal Bahadur Shastri College of Advanced Maritime Studies and Research (LBS CAMSAR) & Marine Engineering and Research Institute (Former D.M.E.T.). LBS CAMSAR is the post sea training institute whereas MERI Mumbai is the pre – sea training institute.

LBS CAMSAR was founded in October, 1948 under the recommendations of the Merchant Navy Training Committee as Central Government premier post sea training institute for Merchant Navy Officers of Navigation & Engineering. And since then, it is offering the comprehensive range of courses for Merchant Navy Officers.

Marine Engineering and Research Institute (M.E.R.I.), formerly known as Directorate of Marine Engineering Training (D.M.E.T.), was established in the year 1949 by the Govt. of India, when the need was felt to train Marine Engineers separately. And since then, it is imparting the education and training to the cadets with a goal of producing the best marine engineers and nautical officers for the world with adopting the latest technology to meet the latest and demanding requirements of the shipping fraternity.
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MESSAGE FROM THE CONVENER

It is very heartening to note that Indian Maritime University – Mumbai Port Campus (Marine Engineering & Research Institute) is organizing a two days Technical Fest Brinicle in association with Maritime Training Trust, D.G Shipping on 28th & 29th March, 2019. This fest is an initiative taken by Maritime Training Trust with an objective of enhancing the maritime knowledge of the participants and to provide all the stakeholders of Maritime Industry an opportunity to gain a great deal of insight into the “emerging technologies”.

I am thankful to IIRE Journal of Maritime Research and Development for collaborating with us. It is pleasing to note that the twelve accepted papers dwell on maritime subjects ranging from Artificial Intelligence, IoT, Inland waterways in India, Sustainable Development, which will dominate the industry in the coming years.

As the success of the event depends ultimately on the people who have worked in planning and organizing it, so I would like to thank the members in all the committees for their great efforts on this success.

Hare Ram Hare
Convener, Brinicle
Editorial

IIRE efforts to ingrain culture of research continues unabated.

A specific seminar is planned in March 2019 at Mumbai bringing researchers, industry and academia together to discuss and highlight the importance of research in the maritime sector.

Yet another opportunity arose when the Indian Maritime University – Mumbai Port Campus invited IIRE to collaborate in the presentation and publication of research based papers of their young cadets pursuing graduate maritime courses. Twelve papers were selected after a process of review which are now being published in a Special edition of the IIRE Journal of Maritime Research and Development. It was heartening to see papers dwelling on some contemporary themes like, Technology inroads into shipping, Sustainable Shipping, Coastal & Inland Waterways that is finding lot of thrust in India. Block-chain technology, Artificial intelligence, Energy efficiency are the areas covered in some of these selected papers. Papers chosen for publication in the Journal was the reward propagated and this brought in much encouragement and healthy competition. The moot idea was once again to engrain the discipline of research in the impressionable minds of the young cadets finding their sea-legs in a dynamic and highly operationalized and challenging shipping environment.

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POTENTIAL OF INLAND WATERWAYS IN INDIA.

Saksham Singh
Varun Pandey

Abstract
India has a total coastline of 7551 km with 13 major ports trust, approximately 200 minor ports. The country has extensive network of inland waterways in the form of rivers, canals, backwaters and creeks. Total Navigable length is 14,500 km, of which about 5200 km of rivers and 4000 km of canals can be used by mechanized craft and cargo. The Purpose of this paper is to find out the Potential and growth in Inland Water Transportation in India and also find out the major problems faced by the organizations involved in this field in India. This paper shows the detailed information about the Inland Water Transportation in India. The paper reveals that how since past few years the growth of Inland Water Transportation have been taken place in India. As per study done in some countries Inland Water Transportation has been known as most cost effective and fuel efficient mode of transportation which attracts the attention of scholars to make some efforts relatively to study of growth and challenges of Inland Water Transportation with reference to India since efforts has been made in this paper to highlight present status, growth, opportunities and problem of Inland Water Transportation in India.

Keywords: Inland Water Transportation, Ports and Transportation.

1. INTRODUCTION:

A sound and efficient transport infrastructure is the key to boosting economic growth and in turn, to alleviating poverty and promoting sustainable development. Inland water transport system ensures both, by way of providing access, mobility and connectivity and generating employment at the grassroots with lesser environmental footprint and cost.

In our civilization, rivers have played a crucial role as a mode of transport in carrying people and goods. Even in the present era, many countries depend heavily on inland water transport, especially for large and bulky cargo.

India is a land of rivers. It has 7500-km long coastline with approximately 14,500 km of navigable waterways. This offers a huge potential for developing a cheaper and greener mode of transport. But only a very small percentage of trade is currently being carried out through these waterways and coastlines. Coastal shipping accounts for only 6 % and inland water transport for about 0.4% of trade.
Nearly 60 % of goods today travel by congested roads 25 % by rail networks. This slows down the movement of cargo, adds to uncertainties, increases the costs of trade, and leaves deep environmental footprints. It has been found that logistics costs in India account for about 18 percent of the country’s GDP, which is much higher than China, USA, UK and many other countries. This makes Indian goods costlier and hence less competitive. As per World Bank analysis, the cost of transport of one ton of freight over a km by road is Rs.2.28, by rail Rs.1.41 and Rs.1.19 for waterways. So, logistics costs in the country can be brought down considerably by transporting more and more goods by waterways.

2. INLAND WATERWAYS AUTHORITY OF INDIA:

In this era of energy crisis, waterways have been found to be a fuel efficient, environment friendly and cost-effective mode of transport, besides having the capacity to ease pressure on rail and road sectors. Inland Waterways Authority of India (IWAI), which came up in October 1986, acts as the nodal agency for optimum utilization of the vast untapped potential of our inland waterways. National Waterways (NW) declared through Acts of Parliament come under the purview of Central Govt/ IWAI; other waterways under the respective State Governments.

2.1. IWAI is mandated to take up: -

- Infrastructure development & regulation on NWs
- Techno- economic feasibility studies
- Advise the Central Government on IWT matters
- Assistance to States in IWT development

3. OBJECTIVE OF RESEARCH WORK

The research paper is prepared for the purpose of determining the Potential of Inland Water Transportation in India. At the end paper will cover each objective comfortably followed by conclusion.
4. RESEARCH METHODOLOGY AND FINDING:

This paper is based on secondary data and information that has been sourced from various books, trade journals, government publications newspapers etc. and research is descriptive in nature.

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, labor 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. In order to regulate inland waterways in India Government of India constitutes a Inland Water Authority of India [IWAI] The organisation got functional in 1986 with a mandate to facilitate the commercial and non-commercial use of channel system.

5. NAVIGABLE WATERWAYS AND INFRASTRUCTURE:

Length of waterways along with its navigable length is an indicator of inland water potential of a state. It is observed that the maximum length of waterways is in the State of Assam with 5290 kms followed by West Bengal with 4741 kms. However, the ratio of the navigable length to the total length of the river/canal better reflects the potential for IWT.

India ranks in 9th 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. 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. Fourteen states have reported river length as well as navigable length for 137 rivers.
Some of the important source of waterways, rivers and canals in India are as follows:
1. River Ganga
2. River Brahmaputra
3. Backwaters of Kerala
4. Goa Waterways
5. Mumbai Waterways
6. River Tapi
7. DVC Canal
8. National Waterways

As per the available data on government website, it is observed that the ratio of navigable length to the total length is about 96.88% in the State of West Bengal; by contrast, in case of Gujrat 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%, 73.14% and 62.40% 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 131 rivers. These 131 rivers have total length of 27962 Km of which 45.57% is navigable length.
6. PROJECTS UNDERTAKEN FOR THE DEVELOPMENT OF IWT:

To promote Inland Water Transport (IWT) in the country, five waterways have been declared as National Waterways. Out of these five NWs, first three waterways have already been developed substantially with fairway of required depth & width, navigational aids & terminal facilities for loading/unloading of cargo & ingress/ egress of the passengers and cargo & passenger vessels are moving on these NWs. A World Bank aided project for capacity augmentation of NW-1 has been sanctioned and it is under implementation.

7. PROJECTS UNDER IMPLEMENTATION:

**National waterway no. 1 and its Salient features**

- The objective of the project is to develop the stretch of river between Allahabad and Haldia to make it navigable for vessels with 1,500-2,000 tonne dead weight capacity. This is close to the carrying capacity of a goods train.

  - For this, the project will develop a navigational channel of 2.2 to 3.0 meters depth and 35- 45 metre width. Multi-modal terminals are being constructed at Varanasi, Haldia, and Sahibganj, besides a Navigational Lock at Farakka.
  - Modern systems of river information, training and conservancy works, night navigation facilities, and other modern facilities like channel marking, navigational lock, etc. are being developed to for efficient and safe movement of vessels.
Phase-I of the project covers the Haldia—Varanasi stretch of the river. Once operational, the waterway will form part of a larger multi-modal transport network having linkage with the Eastern Dedicated Rail Freight Corridor and also with the area’s existing network of highways.

The cargo from the Gangetic states of Bihar and Uttar Pradesh now takes circuitous land routes to reach the sea ports of Mumbai in Maharashtra and Kandla in Gujarat. The development of NW1 will help these states to send some of their freight to the Kolkata-Haldia complex, thus making the movement of freight more reliable with less logistical costs.

A joint venture is afoot with Thompson Design Group, Boston (USA) and Infrastructure Architecture Lab of Massachusetts Institute of Technology, to identify the best locations for construction of 18 ferry terminals in six cities, namely, Allahabad, Varanasi, Patna, Munger, Kolkata and Haldia on NW1.

The NW1 has the future of emerging as the leading logistical artery for the entire northern India, which passes through one of India’s most densely populated areas and resource-rich regions and generates an estimated 40 percent of India’s traded goods. The region’s teeming markets also attract goods from other parts of the country. The network of a water- road-rail link will help the region’s industries and manufacturing units to have a seamless flow of goods to markets in India and abroad. Further, it will also give wider market access to the farmers of this agriculturally-rich Gangetic plain. IWAI is in the process of developing thirty-seven more NWs in the next three years.

National waterway no. 2
Ro-Ro transportation has started between Dhubri and Hasingamari and slipway facilities are being constructed at Pandu on River Brahmaputra, or NW-2.

- **National Waterway No.3**

Normal development works are ongoing on NW-3.

- **National Waterway No.4**
The development of NW-4 (Kakinada-Puducherry Canal along with Krishna & Godavari Rivers),

- **National Waterway No.5**

NW- 5 (East Coast Canal with Brahmani & Mahanadi Delta), NW-16 (Barak), NW-37 (Gandak), NW-40 (Ghagra) and NW-58 (Kosi) also are in progress.

<table>
<thead>
<tr>
<th>NW No</th>
<th>Stretch</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>River Ganga Haldia to Allahabad</td>
<td>1620Km</td>
</tr>
<tr>
<td>2</td>
<td>River Brahmaputra From Dhubri to sadiya</td>
<td>891Km</td>
</tr>
<tr>
<td>3</td>
<td>West Coast Canal From Kottapuram to Kollam with Udyogamandal and champakara canal</td>
<td>205Km</td>
</tr>
<tr>
<td>4</td>
<td>Kalkinada-Puducherry stretch of canals with river Godavari and river Krishna</td>
<td>1078 Km</td>
</tr>
<tr>
<td>5</td>
<td>East Coast Canal with river Brahmani and river Mahanadi’s delta</td>
<td>588Km</td>
</tr>
</tbody>
</table>

While developing the waterways, the legal framework governing inland waterways vessels is also being revamped. Once fully operational, the integrated system of water-road and rail network will herald a new era of inclusive growth and green economy in India.
8. POTENTIAL OF DEVELOPMENT:

i. First Segment: Inland Navigation: Challenges and Opportunities

National Waterways are of significance for their role in inland cargo transportation and as local communication routes. Howsoever, existing navigable waterways lack needed infrastructure, navigational aids, terminals and communication facilities and institutional / policy support. Inland navigation during wet season is regarded crucial, as during this time land-based communication systems (roads) often suffer critical damage from the impact of extreme rainfall, rendering them not suitable for use. At such a time navigation through water is supports transport connectivity for man and cargo.

• National Water Management Agenda: Priorities and Policies: In water resources development agenda of India, navigation is relegated at the end after issues of drinking water, irrigation and power (hydel) sector (Planning Commission, 2006). This reflects the level on importance given to the sector in terms of budget allocation, employment in the sector and policy. The sector deems improved priority to be optimized to its potential.

• Trans boundary issues: structural and political: Most inland waterways, like river systems are trans boundary in nature that means the originating country of river can be different to the country where it finally meets the sea. For example, the NW-1 (Ganges channel between Allahabad-Haldia that stretches 1620 km) downstream closely link with the inland border channel between India and Bangladesh and similar reasoning can make for NW-2 the Sadiya-Dhubri stretch of river Brahmaputra (891 km). Reports suggest, historically the cross-boundary channels were navigated under regional connections and collaborations, the practice that come to almost a close in recent time. At national level, the big challenge is the lack of co-ordination between the state governments and local authorities managing IWT, at cross-country level, stakeholders of river systems such as Ganges, Brahmaputra, Meghna lack cooperation and political agreement essential for the functioning of inland waterways. Dealing with prevailing political bureaucracy, especially hydro-diplomacy in the region [India and Bangladesh], it is interesting to take reference of the historical treaties shared between these countries.
Knowledge base and Information sharing on hydrology of inland navigation: Least Available Depth (LAD) is a critical parameter driving the navigation hydraulics of inland channels. Strengthening capacity of communities, businesses with scientifically calibrated up-to-date information on changing depth of inland water and hydrological changes (as of seasonality effect or other water regulation, allocation/distribution systems) is an obligatory requirement. Addressing excessive siltation in major rivers from erosion of uplands and deforestation are supplementary issues that need attention for improving IWT operations.

Infrastructural Interventions: Unavailability of low draft high technology vessels is another limiting factor. Installment and construction of better navigational aids could possibly increase long time sailing (also during darkness. Building permanent terminals for adequate and efficient loading and unloading of cargo facilitates trade options. IWAI states mechanized handling at terminals and night navigation facilities as requisite (implementation yet due).

Involvement of private sector: Private sector involvement is projected to play a key role for IWT. Improved terminal and warehousing facilities, mechanization of the cargo-handling system, installation of the new navigational aids and maintenance of the existing infrastructure are dimensions requiring attention. In addition, maintaining fairway, providing pilot age services, setting up of IWT training facilities are undertakings of equal requirement. Considering, several levels of possible private sector Build-Operate-Transfer (BOT) scheme, can be negotiated under Public-Private-Participation framework. Alternate way of engagement is to leverage from set of defined incentives as expounded in the dossier of the Directorate General of Shipping (2009).

Private sector players (Hindustan Lever, Ambuja Cements and many others) are currently engaged with IWT. Besides public limited enterprises that include IOCL [Indian Oil Cooperation], Haldia Petrochemicals, FCI [Food Cooperation of India], ONGC [Oil and Natural Gas Commission] and Hindustan Paper Corporation are also in joint operations. With supportive policies, private sector involvement can be expanded.

Navigational and Operational facilities: IWAI coordinates existing IWT facilities. Presence of lock gate at Farakka and barrage system at Kolkata port ensures navigability for NW-1. However, hydro-dynamics seasonality is a dimension
demanding better attention. For example, during winters, the available depth for Ganges is 4-4.5 meter, 6-8 metres during summer and 10-12 m during monsoon. Factoring this variation while designing and operating navigational facilities is important. Like such, floating terminals are preferred for IWT for narrow channel width and for banks inward and outward pushing. Hydrological complexity of inland channels demands tailored requirements for IWT. Taking the reference of an incident where the conventional battery-operated type buoys provided on NW-1 waterway, are often pilfered, rendering these facilities un-available when required, especially during night navigation. To resolve similar situation, beacon type markers (also used in NW III) are less susceptible to thefts. Exchange of experiences between local-level authorities can be effective for maintenance and management of NW’s.

ii. **Second Segment: Inland Water Navigation and Economic Growth.**

To project a strengthened regional trade in South Asia and improve bilateral links, IWT established in coordination with the doctrines of greening the economic growth sounds as a promising option. Take the case of remote industrially (mining) active areas of North-east India (including Bihar, Bengal) that are landlocked and transport mined products mostly by road. NW-1 provides an alternative route for goods to be directly transported to Kolkata (or Mongla) port India (Bangladesh) facilitating national and cross-country trade. Similar possibilities stand for Nepal. Three major tributaries of Ganges: Karnali, Gandaki and Kosi exhibits high probability of connection with NW-1. Main water channel of Nepal, river Kosi River, though non-navigable upstream as of steep terrain can be connected by low-draft barges downstream. To sum, infrastructural arrangements complimented by trans-boundary institutional arrangements is a pre-requisite. Border shared by India and Nepal has Karnali River (or Ghagra in India) flowing to the confluence of Ganges that shows good prospect for navigation. Kayastha (2001) proposed to extend NW-1 (from Allahabad to Hadia) to link with Gandaki River while joining central Nepal, eastern Uttar Pradesh and eastern Bihar. India and Bangladesh have a bilateral protocol, renewed every two years, for India to use the Ganges-Brahmaputra-Meghan river way for water transit between West Bengal and Assam. Taking reference of existing arrangement between two countries further facilitation
can go long way to address above concerns, not just for national level economic
growth, also for regional development.

- Low capital and maintenance cost: Estimations show that developing and building
an inland waterway costs about 5-10 per cent to that of 4-lane highway/railway,
making it a lucrative transportation option with low capital investment. In India,
maintenance cost of IWT is assessed at 20% that of road. Department of Shipping
(India) states that shifting cargo transport to the IWT mode will reduce transport
fuel cost by 5 million USD and overall transport cost by 9 million USD. Other
factors: local conditions of river, fuel cost, and maintenance costs will be
contributing to operational cost as well. IWT may be cost intensive at the start; it is
cost-effective in long term.

- Potential for Integrated design: Integrated transport and trade frameworks/models
(ITF’s) is discussed for optimisation in efficiency and economics (UNCTAD,
2008). Practically a difficult target, it demands elaborate discussions on multiple
aspects (structural and functional).

Let us attempt to understand; (a) Physical integration: refers to connecting different
navigable (hydrological) channels (basin, upstream and downstream). For NW-I, a
prospective connect between inland water routes regions (as far as Himalayas or as
close as Vindhyas) to integrate with marine routes. Infrastructural structures such as
dams/ barrages restrain regular water flow (and LAD) needed for IWT. Construction of
bridges also restricts vertical clearances of navigation vessels (especially heavy-duty
cargo). Despite endowed with numerous navigable rivers only four national waterways
are functional in India (that too with low freight traffic). ITF’s can address much of this
concern.

(b) Functional Integration: refers to connection between National Highways, National
Railways and National Waterways connecting these modes of transport and trade
through a joint regulating authority. For example, the railway freight corridors linked
with the waterways by making special tracks up to NW terminals. Haldia Dock
Complex (NW-1)-inland water terminal provides possible integration point for coastal
shipping with national waterways and re-distributing the cargo in waterways.
Extendable to point-based-point connection with road and rail networks, it is expected
to have relevant applicability and fuel-cost efficiency;
(c) Structural Integration refers to achieving efficiency in integrated design by improving infrastructural/technical facilities viz., linked roads, channels, permanent berths, handling gears like shore cranes and gantries (for containers), mobile cranes, forklift trucks and trailers, storage sheds and warehouses.

- Carbon Efficiency: The goal of Inland Waterways framework is to minimise carbon footprint of development processes. Fuel efficiency is vital to regulate carbon emission. IWT is exceedingly fuel-efficient transport mode with an estimate that one litre fuel can transport 24 tonne/km freight by road, 85 tonne/km by rail and 105 tonne/km by waterways (IWAI-2008/09). With appropriate regulatory measures, IWT as a transport option bears competitive advantage.

9. CARGO MOVEMENT:

The Cargo moved on the three national waterways, waterways of Goa and Maharashtra which carry most of the cargo traffic on India’s Inland Waterways. The total cargo movement on India’s waterways comprising the three national waterways and waterways in the State of Goa and Maharashtra was 365.37 lakhs tonnes in 2014-15 as against 322.63 lakhs tonnes in 2013-14, reflecting an increase of 13.3 %. In terms of tonnage, Goa and Maharashtra accounted for 2.2 % and 74.9 % respectively of the total cargo volume in 2014-15 with balance 22.9 % being accounted by the 3 National Waterways. In terms of tonne km (movement of one tonne of cargo over a distance of one km) there was an increase of 17 % in 2014-15 over 2013-14. Maharashtra waterways accounted around 75% of the total cargo movement on inland waterways across India. In case of Goa and Maharashtra, high volume of cargo movement was carried over relatively short average distances of about 42.82 Kms and 17.88 Kms respectively leading to their intensive use. In case of National Waterway II (The Brahmaputra) and National Waterway III (Champakara canal, Udyogandal canal and West Coast canal) the distance traversed by cargo was on an average around 20.38 Kms and 10.90 Kms respectively in 2014-15. In case of National Waterway, I (Ganga-Bhagirathi-Hooghly) the average distance over which cargo moved was relatively much longer at around 444.73 Kms. 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.
10. CHALLENGES OF INLAND WATER TRANSPORTATION IN INDIA:

i. **Water Flow:** - The basic need for the Inland transportation is sufficient water flow. Due to Industrial, Agriculture and habitation the water flows has been decreased over the years this also may have decreased due to impact of dams of on the rivers.

ii. **Inadequate water channel Depth:** - Large vessels cannot traverse without adequate waters in the rivers. This along with the seasonal dependency of rivers makes operation of many ports difficult.

iii. **Storage Infrastructure:** - Other than certain government run warehouses whose main objective is grain storage, most of the warehouse are small in size and lesser in number. There is inadequate security measure, poor racking system and most important of all these is lack of cold storage facilities in majority of the ports.

iv. **Inadequate Air Draft:** - Multiple bridges with low vertical clearance obstruct the passage of bigger inland water transport vessels on waterways No.3. There several navigable canal in the states of Uttar Pradesh, Bihar, West Bengal, Tamil Nadu and Andhra Pradesh: Sarda Canal, Ganga Canal, Yamuna Canal, The Delta canal system of the Krishna, Godavari, Mahanadi and Brahamani. But these cannot be utilised for cargo movement due to air draft restriction.

v. **Shortage of IWT Vessels:** - Vessels buildings is highly capital intensive and faces difficulties in obtaining project finance from banks and financial institutions. The private sector is relevant to invest in barges unless long term commitments for onward/return trips are made for onward/return trips are made from user’s industries.
vi. **Excessive Siltation:** Deforestation and erosion activity of the river leads to siltation.

vii. **Poor Skills and low technology adoption:** Lack of automation in processes and low multi-operation skills affects efficient utilisation of ports.

Some more challenges

I. Water is a scarce resource in India. It has to first meet the basic requirements of drinking and irrigation before it can be used for navigation. River linkages and water sharing arrangements will have to be worked out between states to estimate the quantum of water required on a time basis throughout the year to maintain the minimum depth of water in the canals for navigability, besides ensuring that drinking, irrigation and other demands of water do not get impacted.

II. The cost savings from water transportation would never be realized unless vessels are able to load to their full tonnage. This is possible only if the rivers are deepened between 2.5 and 4.5 meters and if return cargo is made available for the vessel to avoid wasteful return trips. As we all well aware that most of the Indian rivers are locational, cover small geography and undergo huge seasonal fluctuations even. Some of the rivers generally remain dry which rendering them unsuitable for navigation. There is a need to develop water reservoirs for the conservation of rainwater to feed such rivers.

III. Higher water salinity, especially in the coastal regions and estuaries, and constant inflow of silt in the rivers can be problematic. Along with the minimal water flow continuous dredging is desired as the rivers bring a large amount of siltation.

IV. The financing requirement for inland water transportation is huge and open-ended. The heavy investment will be needed for construction of locking barrages to hold water for vessel movement, concretization and building of embankments to create port terminals and procure equipment, including dredgers, shipping vessels, and barges of different sizes and require river ports with their support infrastructure - road and rail connectivity, warehouses and other services.

V. Inland Waterways Transport (IWT) is a slower mode as compared by Rail and Road by its very nature. So Improper navigational aids further hurt its competitiveness with other modes.
VI. Non-availability of permanent and mechanized handling terminals for loading and unloading with adequate infrastructure, connectivity to the other mode of transport with the terminal is another key factor.

VII. There are road and rail bridges with low vertical clearances which impede the passage of bigger IWT vessel on the waterways. There should be a long-term vision for the development of dams, bridges and other in-way infrastructures.

11. PROMOTIONAL MEASURES BY GOVERNMENT TO SUPPORT INLAND WATER TRANSPORTATION:

The Government with a view to promoting Inland Waterways Transport (IWT), has launched several schemes. Some of the same are listed hereunder:

- Vessel Building Subsidy of 30%
- Equity participation by Govt. in BOT (Build operate transfer) Projects up to 40%
- Viability Gap Funding
- Tax exemption similar to National Highways
- Enhancement in depreciation rate for inland vessels
- Joint Venture by IWAI
- Customs Duty concessions

- Under the Sagaramala project government will identify suitable port locations with deep drafts to enhance shipping and port handling capacity. Specialized ports with focus on handling coal, energy, chemicals, commodities, etc., will be developed.

In way of some strong moves for Inland Waterways Transport (IWT) the Cabinet Committee on Economic Affairs (CCEA) has approved implementation of Jal Marg Vikas Project (JMVP) for capacity augmentation of navigation on Haldia-Varanasi stretch of National Waterway-1 on Ganga River. The project will be implemented at a cost of over Rs. 5,370 crore rupees with the technical assistance and investment support of the World Bank. It is expected to be completed by March 2023.

Along with the above initiatives the Government, with a view to promoting public-private partnership(PPP) in IWT sector, has identified several areas which include:
• Construction and operation of river terminals or river ports. Ownership and operation of vessels for cargo and passenger,
• Provision and operation of mechanized cargo-handling systems
• Fairway development and maintenance
• Putting up and maintenance of navigational aids and setting up and running of training IWT training institution.

12. LADIS PORTAL LAUNCHED BY THE GOVERNMENT:

The Inland Waterways Authority of India (IWAI) launched a new portal LADIS on 16th February, 2019 – Least Available Depth to aid in ensuring of optimum use of National Waterways. An assured depth of waterway is required for seamless movement of vessels. The portal will provide real-time data on at least available depths for ship/barge and cargo owners so that they can undertake transportation on NWs in a more planned way. The real-time information in stretches of various NWs will help transporters by guiding them on the suitability of time of movement.

LADIS will better facilitate the day to day operations of inland vessels plying on National Waterways and avoids any hindrance in service and operation. LADIS will enhance the credibility and efficiency of information sharing to achieve seamless operations on National Waterways, besides pre-empting problems that may occur during the movement of vessels.

13. MAERSK RUNS CONTAINERSHIP ON GANGA (NW-1):

The world’s largest container shipping company Maersk Line moved 16 containers on the Ganga river from Varanasi to Kolkata, the Shipping Ministry said Monday.

“Maersk Line has moved 16 containers on river Ganga (National Waterway-1) from Varanasi to Kolkata. The firm is onboard India’s inland waterways for the first time,” the ministry said in a statement. On November 12, 2018, Prime Minister Narendra Modi dedicated India’s first riverine multimodal terminal on river Ganga (National Waterway-1) at Varanasi to the nation.

The government is developing NW-1 under from Haldia to Varanasi with the technical and financial assistance of the World Bank at an estimated cost of Rs 5,369 crore, the
ministry said. Earlier firms like PepsiCo, Emami Agrotech, IFFCO Fertilizers, Dabur India, had moved their containers on river Ganga, it added.

14. SOME ADDITIONAL ACTION SHALL BE TAKEN TO MEET THE CHALLENGES:

- The Indian Government should focus more and put some special efforts and funds on the development of “commercially significant IWT.”
- IWT as a mode will not commercially profitable for operators unless we apply more than 1000 DWT which requires a minimum draft of 2.5 to 3m round the year with night navigation facilities. The construction of dams, barrages, bridges should consider navigation as an important requirement and make provisions for the same.

![Diagram of inland water transport](image)

Source: GAO. | GAO-16-682

Dam arrangements for inland water transport Barges

- IWT being a dependent mode, there is a strong need to provide effective rail, road and coastal connections from the waterways for multi-modal logistics. The terminals should be located close to industrial hubs or consumption centers and should provide connectivity to both rail and Road. Connectivity with Coastal shipping is possible at all National Waterways.
• Strong steps need to be taken to encourage vessel availability in Revival of Vessel Building Subsidy scheme, abatement of service tax, granting of vessel building an “infrastructure status” and ensuring two-way cargo to vessel operators, round the year.

• The government should target specific cargo like Coal, Cement, Fertilizers, Food grains and all the users of these cargoes close to National Waterways need to be met, their requirements to be understood and specific solutions to be developed for them on the long-term basis.

• The pace of project implementation is far from Even after 30 years of its declaration we are still not able to provide the lowest available draft of 3m on the whole stretch of NW1. The speed of Implementation should be increased and the projects need to be time-bound and implemented with urgency.

15. JOB OPPORTUNITY FOR SEAFARER’S.

• More job opportunity for marine floating staff due to increase in the number of the fleet.

• Ships pilots to Guide commercial vessels in and out of bays, harbors, rivers as required

• For port and harbors operation Executive port directors who can oversee the administration, operation and maintenance of an inland port. A person with good leadership, planning, critical thinking and good communication skills, inspirational diplomatic and resourceful skills will be suitable for the same.

• Marine Manager- Oversee daily operation and services of marine facilities, perform supervisory, financial administrative, customer services, maintenance and various other duties.

• Inland water transportation equipment manufacturing industry

• Naval architect –it includes the research, design and construction of commercial vessels, small craft, and marine structure.

• **Design, construction and maintenance of transportation system** involving the construction of locking barrages to hold water for vessel movement concretization and building of embankments to create port terminals. Its further includes regular (high-intensity) capital dredging of river sediment deposition along channel bottoms and margins. It also includes modern river information system and Digital
Global Positioning System for night navigation and Development of water traffic control system.

- Ship and port safety officer
- Port inspectors and ship surveyors
- Cargo managers
- More container depots
- Logistics and multimodal transportation
- Marine environment pollution prevention will further flourish job opportunities.
- Marine chartering and cargo brokers.

16. CONCLUSION:

The Inland Water Transportation has experienced high growth over the last decade with the visible shift towards development of navigable waterways. The cargo movement has been reached at 8.38 MMT in the year 2016-17, with a growth of 181.20 % has been seen over the decade which is good sign for the IWT in India but there are some challenges also associated these are lack the water flow, adequate depth and shortage of vessels etc. which needs the government to pay attention and invest resources as well as increase the navigable length.

Government of India aims to develop and harness the potential of Inland Water Navigation in order to bolster optimal and sustainable use of water systems. Setting up Inland Water Authority and declaration of National Waterways was a first step towards this objective. Even though in a broad sense, growth of IWT sector is not very aligned with development objectives, further development in this sector sounds promising as a carbon efficient alternative. Installment of better navigational aids, and infrastructure facilities remain a key requirement to increase effectiveness of the sector.

In current times, efficient energy consumption and green economic future is a pressing goal, IWT sector assures to be less fuel consuming (making it a best bet to expand and develop). Building essential infrastructure like mechanized handling at terminals and night navigation facilities is pertinent. Other enabling conditions include clear
framework of national level procedures, incentives, policies, and subsidies. Such stimulus can translate into cost reduction per ton-km (TKM) over short and long haul.

**IWT sector has immense Potential** and promises to sustain, enhance and engage the interaction with people whose livelihoods and socio-economic security depends on inland water resource. One can note that data limitation and lack of up-to-date scientific assessments are limiting factors for timely decision making for IWT.

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