

**A STUDY ON INLAND WATER TRANSPORTATION IN INDIA
(With special reference to National Waterway-1)**

*Project Report Submitted for Partial fulfillment of the requirement for the
degree of*

**MASTER OF BUSINESS ADMINISTRATION (MBA)
In
PORT AND SHIPPING MANAGEMENT**

By

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July, 2020

DECLARATION

I **Abhishek Kumar**, Registration No. **1803304003** student of **School of Maritime Management, Indian Maritime University, Chennai Campus** pursuing **Master of Business Administration in Port and Shipping Management**, hereby declare that this report titled "**A STUDY ON INLAND WATER TRANSPORTATION IN INDIA**" (With Special Reference to **National Waterway-1**) has been prepared by me towards the partial fulfillment of the requirement for the award of degree of **Master of Business Administration in Port and Shipping Management** under the guidance of **Dr. A. Mourougane**, Associate Professor & Head, School of Maritime Management, Indian Maritime University, Chennai Campus.

I also declare that this project report is my original work and has not been copied from any other report previously submitted for the award of any Degree, Fellowship, or Other similar title.

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Abhishek Kumar

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LIST OF ABBREVIATIONS

SL No.	Abbreviated Name	Full Name
1	NW-1	National Waterway-1
2	IWAI	Inland Waterways Authority of India
3	RO-RO	Roll On- Roll Off
4	CIWTC	Central Inland Water Transport Corporation Limited
5	DWT	Dead-weight Tonnage
6	FDI	Foreign Direct Investment
7	GDP	Gross Domestic Product
8	GST	Goods and Services Tax
9	IT	Information Technology
10	PPP	Public Private Partnership
11	JMVP	Jal Marg Vikas Project
12	LAD	Loadable Distance
13	RITES	Rail India Technical and Economic Service LTD
14	M&A	Mergers and Acquisitions
15	MLIT	Ministry of Land, Infrastructure, Transport and Tourism
16	MOF	Ministry of Oceans and Fisheries
17	NDRC	National Development and Reform Commission
18	R&D	Research and Development
19	SEZ	Special Economic Zones
20	SMEs	Small and Medium Enterprises
21	CEZs	Coastal Economic Zones
25	UNCTAD	United Nations Conference on Trade and Development

EXECUTIVE SUMMARY

The Indian National Waterway Project 1 which is also known as the Ganga-Bhagirathi-Hooghly river system stretch from Allahabad to Haldia covering 1620 km. National Waterway 1 is India's first ever inland waterway transportation route which comes under Inland Waterway Authority of India. IWAI along with World Bank is backing this project financially. The main motive of introduction of Inland Transportation system in India is to bring down the logistics cost which is around 14%-15% of GDP currently in comparison to countries like China, USA, and countries in European Union whose logistics cost is only 6%-8%. The another main reason behind this project is to harness the potential of the Indian River, countries like India have numerous amount of river which are only being used for irrigation, fisheries and power production but we can use this River network for the sake of transportation of the cargo from one place to another place.

This report is prepared to study the various prominent dimensions of this National Waterway-1 for instance what is the objective, needs, cargo potential, issues challenges, opportunity, viability, cost effectiveness etc. The focus of this project is to know about viability of this project and to know what shippers feels about this project. This massive project requires huge amount of money that is why Government of India and World Bank is funding in 50:50 ratio. If we talk about the types of cargo which can be transported from this stretch are like stone chips, coal, fertilizer, food items, cement, fly ash etc.

There are various infrastructure activity is going on under which construction of Multimodal terminal, RO-RO jetty, barge repair and maintenance facility, differential global positioning system, draft maintenance, navigational facility and many more are there.

CHAPTER I

INTRODUCTION

1.1 Introduction

Inland Waterways of India has around 14,500 km of traversable and fit safe navigation however indeed around 5,200 km of the waterway and 4,000 km of trenches can be utilized by motorized artworks. India's Inland Waterways are not appropriately used when contrasted with different nations in the World. The all out freight moved (in ton-kilometers) by the inland waterways was only 0.5% of the all out inland traffic in India. The Inland Waterways Authority of India (IWAI) came into fact on 27th October 1986 for advancement and guideline of inland waterways for transportation and route. Its central station is situated in Noida, Uttar Pradesh. The IWAI announced five National Waterways in India and furthermore proposed the 6th one. India has around 14,500 km of traversable Waterway involving waterways, trenches, backwaters, rivulets. This is notwithstanding the coastline of 7,517 km covering the terrain, Lakshadweep Islands, and the Andaman and Nicobar Islands. By and by, Inland Waterways activity is confined to a couple of stretches in the Ganga-Bhagirathi-Hooghly Rivers, the Brahmaputra, the Barak River, the streams in Goa, the backwaters in Kerala, inland waters in Mumbai and the deltaic areas of the Godavari – Krishna River.

The Waterways's stretch among Kolkata and Delhi goes through one of India's most thickly populated territories. As indicated by a World Bank study, a sizeable 40 percent of all India's exchanged merchandise either start from this asset rich locale or are bound for its abounding markets. While the locale is evaluated to produce around 370 million tons of cargo yearly, just a little portion of this roughly 8 million tones at present travel by water.

These long Waterway in India give a decent method of transport athwart the urban areas just as towns, similar to backwaters of Kerala, Canals in Gujarat and not many Waterway in Goa, West Bengal, and Assam. Cargo transportation by Waterway isn't enough used in India. The aggregate sum of payload being moved (in ton-kilometers) by the inland Waterways was less of the all out inland traffic in India, contrasted with the 21% figure for the United States. Indian water transportation is accepting noteworthy enthrallment as of late since coordinations cost

in India is one of the most noteworthy among significant nations – according to one significant reports it is 18% in India versus 8-10% in China and 10-12% in European Union.

The duty of advancement of these rests with the Inland Waterways Authority of India (IWAI). This position, alongside Central Inland Water Transport Corporation (CIWTC) as the foremost administrator, is the two Central organizations occupied with the nation. The endeavors of these associations are enhanced and upheld by inland water associations of different States and private administrator.

In mainland Europe, out of 26,000 km of traversable Waterway, 17,000 km length is having profundity more than 2.75 m. The European Union (EU) has propelled a particular modular move program called "Marco Polo" in 2003. In China, out of 119,000 km of safe Waterway, 5000 km length is having profundity more than 2.75 m. In addition, 2000 inland ports exist in China. In the USA, out of 41,000 km of safe Waterway, 24,000 km length is having profundity more than 2.75 m. The IWT modular offer in the Netherlands is 42%, France 15%, Hungary 15%, Germany 14%, Belgium 13% and in the US 15%.

1.1.1 Types of Inland Waterways

Inland navigation channels for the commercial traffic are generally three types: open river waterways, canalized waterways, and canals.

- **Open river navigation:** There are few rivers where the discharge is adequate throughout the river to provide suitable channel dimensions for year-round commercial navigations of modern vessels and barges. The natural factor which restricts open river navigation particularly, in the freshet reaches include very high-velocity currents, decreased depth in low water period, sediment deposition in the channel and natural hazards in the form of rapids/outcrops. Under such circumstances, engineering measures (river training or rectification and stabilization) include the construction of spurs, dikes, and longitudinal dykes, revetments and so on for the channel regulation to provide and maintain adequate channel dimensions for navigation. The National Waterway 1 (Ganga-Bhagirathi-Hooghly river system) and National Waterway 2 (the river Brahmaputra) come under open river navigation.

- **Canalized waterways:** A canalized river is one that has been transformed from a free-flowing stream to a series of slack-water pools by the construction of a number of locks and dams. The flow in the canalized waterway is to a greater or smaller degree controlled by engineering works. In India, no such waterways have been exclusively developed for navigation.
- **Canals:** Canals are developed for connecting two or more water bodies. Navigation canals are thus entirely artificial waterways whose water is obtained by diversion from rivers/reservoirs. The national Waterways 3 (WCC), National Waterway 4 and national waterway 5 come under this classification.

1.1.2 Inland Waterway of India

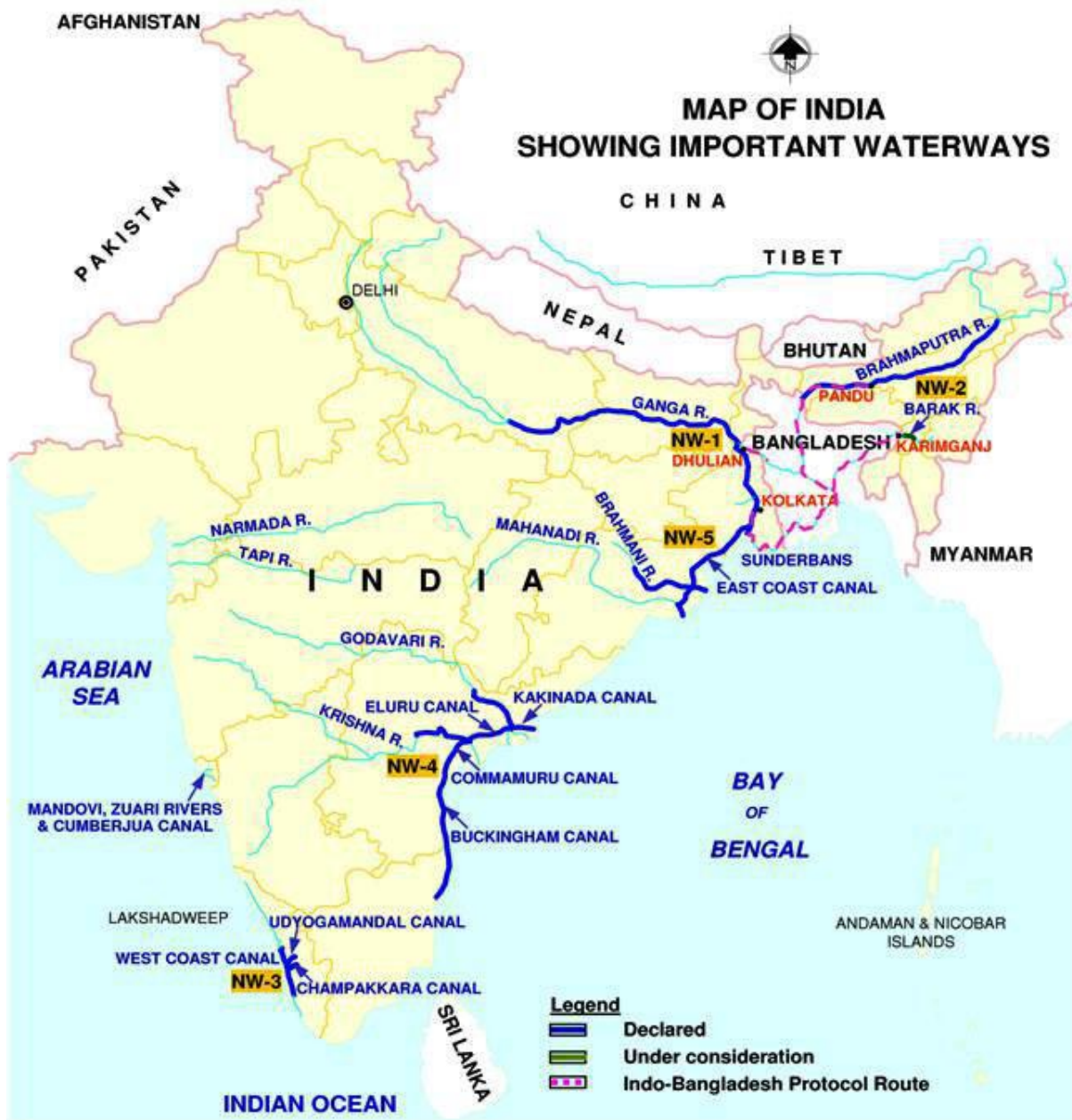
- **National Waterway 1:** Varanasi-Haldia stretch of the Ganges–Bhagirathi–Hooghly river system having a length of 1620km with expected cargo movement of 4 million tons.
- **National Waterway 2:** Sadiya-Dhubri stretch of Brahmaputra river system having a length of 891km with expected cargo movement of 2 million tonnes.
- **National Waterway 3:** Kozhikode-Kollam stretch of the West Coast Canal, Champakara Canal, and Udyogmandal Canal having a length of 205 km with expected cargo movement of 1 million tons.
- **National Waterway 4:** Kakinada-Puducherry stretch of canals and the Kaluvelly Tank, Bhadrachalam – Rajahmundry stretch of River Godavari and Wazirabad – Vijayawada stretch of River Krishna having a length of 1095km.
- **National Waterway 5:** Talcher-Dhamra stretch of the Brahmani River, the Geonkhali – Charbatia stretch of the East Coast Canal, the Charbatia–Dhamra stretch of Matai River and the Mangalgadi – Paradip stretch of the Mahanadi River Delta having a length of 623km.
- **National Waterway 6:** In Assam, Lakhimpur to Bhangra of river Barak having the length of 121 Km.

1.1.3 Project Need

Inland waterways transport (IWT) is a competitive alternative to road and rail transport, offering an economical, sustainable and environmentally friendly mode in terms of energy consumption, noise, and greenhouse gas emissions. Infrastructure requirements of IWT in comparison to road and rail transport are also relatively low, although certain investments are essential such as in port/terminal facilities, connecting road/rail infrastructure, navigation aids, and maintenance dredging facilities. While cargo movement through other modes of transportation is often confronted with congestion and capacity problems, IWT offers a relatively congestion free and reliable mode of transport along with the availability of unmatched capacity expansion due to its largely untapped potential.

Till the middle of the 20th century, IWT was being used as an important mode of transport in various parts of India but gradually it got confined to unorganized sector except in few states namely Goa, Assam, West Bengal, Kerala and Maharashtra primarily due to focus shift in transportation through rail and road modes. One of the key challenges for India in accelerating economic growth and trade competitiveness remains the congested road and rail systems and the virtual absence of multi-modalism to provide more efficient and flexible supply chain. In order to reverse the decline and build a logistics infrastructure capable of efficient handling of rapidly growing freight traffic, India would need to pursue an integrated and coordinated approach and optimal utilization of all transport model .

Fig. 1.1 National Waterways of India



Source: Inland Waterway Authority of India, Website

1.1.4 Benefit of Inland Waterways

- As the acquisition of land for national and State highways becomes exiguous and the cost of construction of roads, flyovers, and bridges goes up, the government is now exploring using water as a means of public transportation.
- Water transport is not only environment-friendly but also reasonable than other modes of transport.
- It takes lesser time to transport cargo by waterways in some areas and the chances of congestion and accidents on highways are ruled out.
- There is a huge capability for domestic cargo transportation as well as for cruise, tourism and passenger traffic.
- There is huge potential for public-private partnership (PPP) led investments in dredging, construction, operation and maintenance of barges, terminals, storage facilities, and navigation, as well as tourism.
- It will help in the creation of millions of job opportunities.
- It will abet the maritime trade of the states and accelerate their economies.
- It provides a much more flexible service than railways and can be adjusted to individual necessity.

1.1.5 Basic Requirements for National Waterway

The National Transport Policy Committee (1980) recommended the following principles for declaration of a national waterway.

- It should possess the capability of navigation by mechanically propelled vessels of a reasonable size.
- It should have about 45 m wide channel and minimum 1.5m depth.
- It should be a continuous stretch of 50 km. The only exception to be made to waterway length is for urban conglomerations and intra-port traffic.
- It should pass through and serve the interest of more than one State (or).
- It should connect a vast and prosperous hinterland and Major Ports (or).

- It should pass through a strategic region where development of navigation is considered necessary to provide logistic support for national security (or).
- It should connect places not served by any other modes of transport.

1.2 Importance of the Study

The National Waterway have a good hinterland to serve. It covers a longer stretch of Ganges and cater to many industries.

A well-coordinated inland waterways network could bring a fundamental alteration in the logistics scenario of the country. It represents a ready built infrastructure network, which can be utilised without any further capital investment. The network requires no green field investment, but only capex for improvement/upgradation. Waterways can decongest roads, including highways by moving cargo away. Waterways do not involve challenges associated with land acquisition, which has always been a sensitive issue, causing time and cost overruns of numerous projects. The significant investment which India needs to build its roads/highways infrastructure network can be conserved through increased utilisation of the waterways. User charges can be levied to meet the expenses on maintenance of the waterways.

Jal Marg Vikas Project(JMVP) was announced by Government of India in 2014-15 Budget to enable the navigation of min. 1500 tonnes of vessel on river Ganga covering a stretch of approx. 1620km.

The Project aims to develop a fairway with min. 3m depth to enable commercial navigation. It also includes along with development of fairway, facilities like Multi-modal terminal, strengthening of open river navigation technique, conservancy work, Modern River information System, etc.

The development and operation of NW-1 will provide alternative mode of environment friendly and cost efficient transport mode. The project will help in bringing down the overall logistics cost of the country along with reduction in traffic burden and congestion on roads and railways. It will also give boost to Socio-Economic development and will help in Employment generation.

1.3 Review of Literature

1.3.1 National waterways of India- Prof. B.S. THANDAVESWARA (IIT MADRAS)

India is the largest peninsula in the world with a coastline of about 6000 kms with 12 major ports and 163 minor / intermediate ports. Nature has given us a more impressive, nearly 14500 kms of navigable and potentially navigable inland waterways - which include a network of rivers, lakes and canals. The Inland Waterways Authority of India (IWAI), an apex body for development and regulation of inland waterways for shipping and navigation has identified ten waterways for initial consideration for development out of which three have been declared as National Waterways, which are:

- **National Waterway-1 (NW-1)- The Ganga (North India)**

The Ganga-Bhagirathi-Hooghly River System connecting Haldia-Kolkata (Calcutta) -Farakka - Munger - Patna - Varanasi - Allahabad. The NW-1 stretches to more than 1620 Kms of potentially navigable waterways. River conservancy works, dredging, day channel marking and bandalling are carried out on a year-to-year basis. Provisions for 1.5 - 2m depth channels, night navigational facilities are in the process of implementation.

- **National Waterway-2 (NW-2)- The Brahmaputra (North-East India)**

The river Brahmaputra connecting Dhubri-Pandu (Guwahati)-Tezpur-Neamati-Dibrugarh-Sadiya stretching to about 891 Kms was declared a National Waterway in the year 1988. River conservancy works, dredging, day channel marking and bandalling are carried out on a year-to-year basis. Provisions for 2-meter depth channels, night navigational facilities are under consideration. An inland Water Transport transit and trade protocol exists between India and Bangladesh. The NW-2 connects the North East region with Kolkata and Haldia ports through Bangladesh and Sunderbans waterways.

- **National Waterway-3 (NW-3)- The West Coast Canal (South-West India)**

The west Coast canal located in Kerala runs from Kollam to Kottapuram and was declared a National waterway in 1993. The dredging of this canal is done. The NW-3 is one of the most navigable and tourism potential area in India and has much to offer to the potential tourists.

1.3.2 India's National Waterways, A long Way to Go

By Dr. K.G.S. Sharma (Additional GM Ports & Waterways, India)

The growth of roads and railways and commodity diversity have progressively led to the extinction of commercial Inland water Transport (IWT). Till early sixties, Inland water Transport continued to play a major role for transportation of cargo along the rivers Ganga and Brahmaputra.

There are few rivers where the water level is adequate throughout the year to provide suitable channel dimensions throughout the year for commercial navigation. The natural factors which restrict the open river navigation, include, High velocity currents, decreased depth in low water periods, sedimentation and natural habitat. Under such circumstances, engineering measures such as Construction of spurs, dykes, revetments and provide continuous dredging, is needed to improve navigation. The National waterway-1 and National Waterway-2 come under open river navigation.

1.3.3 The Working Group Report On Shipping and Inland Water Transport for 11th 5 year Plan

The topic identifying with Inland Water Transport falls in all the three arrangements of the Seventh timetable of the Constitution of India. The selective ward of the Central Government is just as to delivery and route on inland Waterway announced by an Act of Parliament to be national Waterway. Transportation and route on different Waterway as for precisely pushed vessels falls in Concurrent rundown while route by vehicles other than precisely impelled vessels is selective purview of State Government.

India has around 14,500 km of safe Waterway which include waterways, channels, backwaters, springs, and so on. Around 45 million tons of payload (2.50 billion ton-Km) is being moved every year by Inland Water Transport (IWT), an eco-friendly and condition cordial mode. Its activities are right now limited to a couple of stretches in the Ganga-Bhagirathi-Hooghly Rivers, the Brahmaputra, the waterways in Goa, the backwaters in Kerala, the Barak River and the deltaic locales of the Godavari-Krishna streams. Other than the sorted out activities by motorized vessels, nation pontoons of different limits likewise work in different waterways and channels.

The idea of National Waterways was acquainted in 1982 with give a lift to the advancement of inland water transport in the nation. At present, there are three Waterway that have been pronounced as National Waterways. These are Ganga, from Haldia to Allahabad (1,620 km), the Brahmaputra, from Dhubri to Dadiya (891 km) and the West Coast Canal from Kottapuram to Kollam including Champakara and Udyogmandal waterways (205 km). Move is being made to announce East Coast Canal alongside streams Brahmani and Mahanadi delta Kakinada-Pondicherry Canal alongwith Godavari and Krishna waterways and Barak stream as National Waterways.

The duty of advancement of these Waterway rests with the Inland Waterways Authority of India (IWAI). This power, alongwith Central Inland Water Transport Corporation (CIWTC) as the primary administrator, are the two Central organizations occupied with the nation. The endeavors of these associations are enhanced and upheld by inland water associations of different States and private administrators.

In mainland Europe, out of 26,000km of traversable Waterway, 17,000 km length is having profundity more than 2.75 m. The European Union (EU) has propelled a particular modular move program called "Marco Polo" in 2003. In China, out of 119,000 km of safe Waterway, 5000 km length is having profundity more than 2.75 m. Additionally, 2000 inland ports exist in China. In USA, out of 41,000 km of traversable Waterway, 24,000 km length is having profundity more than 2.75 m. The IWT modular offer in Netherlands is 42%, France 15%, Hungary 15%, Germany 14%, Belgium 13% and in US 15%. India has 14,500 km of safe Waterway, of which around 5700 km is safe by motorized vessels, anyway the modular portion of IWT in India is 0.28% as it were.

Before the finish of eleventh Plan, three new Waterways are probably going to be added to the current 3 NWs, taking the all out inclusion to 4500 Kms. Two bills for announcing East Coast Canal and Kakinada-Pondicherry Canal alongwith Godavari and Krishna streams as national Waterway have just been presented in the Parliament. The concentration in eleventh Plan will be to put essential foundation on the current Waterway, make them completely utilitarian, take up second period of advancement and continue ahead with improvement of new NWs on quick track. When the division creates and arrives at an edge level, private financing/extra budgetary assets will begin streaming naturally. All riverine States ought to create Waterway as feeder courses to National Waterways by embracing the fish-bone model

of advancement. Significant Waterway of the States ought to be recognized and named "State Waterways" for need subsidizing. More finances will be required during eleventh Plan as reaction of CSS during tenth arrangement has been empowering.

Sub bunch on IWT has proposed to advance vessel acquisitions through JV course and further proposed an expense of Rs. 500 crore (Budgetary help) and comparing EBR of Rs.2625 crore on this record. on this record. The working gathering feels that at first Rs 100 crore might be saved for this plan during the eleventh Plan. Thusly, comparing EBR for this will be diminished to Rs.525 crore Accordingly, the arrangement projections will be decreased to Rs 9000 crore.

1.4 Objectives of the Study

- To Understand and Analyse Cargo movement through Inland Water Transportation in India.
- To study the advantage of Inland water Transportation over other modes of transport.
- To study the feasibility & Estimate future traffic potential (Cargo and Passengers) of NW-1 for River Transportation.

1.5 Research Methodology

This Part describes the way in which the study is conducted in terms of methods of data collection, analysing, interpreting and reporting the results.

1.5.1 Research Questions

- Identify the opportunities & threats of IWT
- Analyse the infrastructure on NW-1 for commercial navigation

HYPOTHESIS:

H1- There is Potential of Cargo movement through IWT

H2- There is potential of passenger movement through IWT

1.5.2 Research Gap

- The Major objective of the project is to find out why the project (NW-1) is not in full swing. In spite of Inauguration by Prime Minister, including in sagarmala project, still there is restricted or limited amount of cargo movement.
- The cost of Transportation is going up day by day but still there is very limited use of NW-1.
- If the transport of goods through NW-1 becomes regular, what will be the capacity and potential.

1.6 Limitations of the Study

The Inland water Transportation in India is a very wide topic and time factor has been an important constraint in this study of the topic. All the data's collected may not be precise due to confidentiality of data. Following the means of secondary data Collection and Govt. database on Inland water Transportation the research has been done.

Limited Journals, books and research papers are available on this context.

CHAPTER II

OVERVIEW OF NATIONAL WATERWAYS 1

2.1 National Waterway 1

Ganga-Bhagirathi-Hooghly stream framework from Allahabad to Haldia was proclaimed as National Waterway 1 (Allahabad-Haldia stretch of the Ganga Bhagirathi-Hooghly waterway) Act 1982 (49 of 1982). This national Waterways is the longest inland Waterway in India. It begins from Haldia port on stream Hooghly and running along the waterway Ganga closes at Allahabad city. This waterway goes through the conditions of West Bengal, Jharkhand, Bihar, and Uttar Pradesh. It got usable from 27th Oct 1986 after the arrangement of the IWAI. The Waterways stretches out from Haldia to Allahabad for a separation of 1620 km.

2.2 Project Description

The total estimated cost of the project is ₹5,369.18 crores, which will be equally shared between the Government of India and the World Bank. Proposed Project-Jal Marg Vikas aims at the improvement of navigation in the entire stretch of 1620 km. of NW-1 (Haldia to Allahabad). NW-1 is the Ganga - Bhagirathi - Hooghly river system. NW-1 is being fed by various tributaries at different locations. Major tributaries of river Ganga in NW-1 between Haldia to Allahabad are Tons, Gomti, Ghagra, Son, Gandak, Punpun, and Kosi. This project crosses through 4 States name Uttar Pradesh, Bihar, Jharkhand, and West Bengal. The following interventions have been proposed and planned under the Jal Marg Vikas Project.

- Maintenance dredging to provide the required LAD in this waterway channel and also for various proposed terminal facilities.
- Improved Navigation Infrastructure & Navigation Aids
- Construction of 5 Ro-Ro crossings & ferry passenger jetties. Locations of these jetties are yet to be identified.
- Construction of 6 terminals: Site identification and planning for 3 terminals sites at Sahibganj, Varanasi, and Haldia is accomplished. Besides 2 more potential sites for the

development of terminals are also identified at Ghazipur and Kalughatand 1 site, i.e. at Kalyani in Tribeni is under consideration.

- Construction of one new navigation lock at Farakka, West Bengal.
- Provision for tow barges, inland vessels, survey vessels including rescue boats and survey equipment. Development of low draught vessel.
- Development of navigation aids along NW-1 for the facilitation of day & night time navigation.
- Development of efficient River Information System with all hardware & software.
- Provision for bank protection/slope protection and river training works for critical locations.

Fig. 2.1 Map of National Waterways 1



Source: Inland Waterway Authority of India Website

The project also envisages the creation and improvement of integration opportunities with other surface transport modes such as roads and railways, so as to improve the overall efficiency of the logistics chain by linking the waterways through various well-equipped terminals and jetties. Cargo proposed to be transported in NW-1 includes cement, fly ash, iron ore, iron ore fines, coal, steel shed, tyres, iron fines, iron ingots, Galvanized steel plain sheets, stone chips, furnace oil, high Speed diesel (HSD), lube oil, boulders, pulses, aluminum block, sand, chips, ship blocks, food grains, manganese ore, petroleum products, coke, coking coal, rock phosphate, timber, peas, slag oil, and non-cooking coal. As per the survey traffic, current traffic transported via rail & road between Haldia & Varanasi is 4,26,130 tons. Traffic projection studies are carried out and as per the study, projected traffic for the year 2045 is 48,011,367 tons. Under NW-1, 6 nos of terminals are proposed out of which planning for 3 terminals is completed.

2.3 Project objective

The Project Development objective is to upgrade transport proficiency and unwavering quality of National Waterway 1 and enlarge institutional limit with respect to the turn of events and the board of India's inland Waterways transport framework in a naturally practical way. The Project focuses on the improvement of navigational in the whole stretch of NW-1 and proposes to increase the limit of the whole stretch and keep on keeping up the Waterway of the whole stretch between Haldia to Varanasi. The limit enlargement would focus on the improvement of all necessary foundation like terminals and boat lock for powerful and economical route consistently.

2.4 Fairway Development

A fairway with targeted depth and width has been developed/maintained on NW-1 for the purpose of smooth and safe navigation. This was achieved by undertaking River Conservancy measures like bandalling, dredging, etc. in Tribeni-Chunar (1226 Km) stretch of NW-1. The stretch between Haldia (Sagar) – Tribeni (196 km) is tidal and the Least Available Depth (LAD) of more than 3.0 m is maintained naturally. IWAI was not undertaking any River Conservancy works beyond Chunar to Allahabad stretch except day channel marking as the dredgers owned by IWAI being used in lower 10 stretches of NW-1 due to more traffic demand.

Although, the day navigational aid being provided an entire stretch of NW-1 from Haldia (Sagar) to Allahabad (1620 km).

During 2017-18, Bandalling works of 3,900 meter in Tribeni - Rajmahal (399 km) stretch and 18,300 meters in Rajmahal-Chunar (827 km) stretch were executed for developing and maintaining the navigation channel (fairway), besides some channel stabilization. Further, 1.46 lakh m³ dredging in Tribeni – Rajmahal and 7.24 lakh m³ dredging in Rajmahal - Varanasi / Chunar stretches were carried out by deploying IWAI’s dredgers.

Fig. 2.2 Dredging in progress through the pipeline on National Waterway-1-



Source: Inland Waterway Authority of India Website

The detail of Least Available Depth (LAD), which is maintained for various stretches of NW-1 is as follows:

Stretch	Length	Draft
Haldia-Farakka Stertch	560km	2.6m to 3.0m
Farakka- Barh Stretch	400km	2.1m to 2.5m
Barh-Ghazipur Stretch	290km	1.6m to 2.0m
Ghazipur-Chunar/Allahabad	370km	1.1m to 1.5m

2.4.1 Cargo Movements

The transportation of Coal for NTPC Power Plant is being embraced since November 2013 from sand heads (Bay of Bengal) to Farakka through National Waterway–1. During FY 2018-19 more than 1.60 lakh huge amounts of imported Coal (up to July 2019) has been shipped effectively by M/s Jindal ITF Ltd. utilizing the scows of 1500 – 2000 tons' ability. Besides, around 30 lakhs tons' load including fly debris, food grains and general payload moved among India and Bangladesh through National Waterway - 1 and Indo-Bangladesh Protocol Route under Inland Water Transit and Trade. Likewise, the preliminary development of 240 tons of stowed concrete from Kolaghat situated on stream Rupnarayan (NW-87) to Bhagalpur on waterway Ganga (NW-1) and 300 tons of sacked fly debris from Kahalgaon (NW-1) to Kolaghat of M/s Dalmia Bharat Cements has been finished by IWAI's shallow draft payload vessel MV VV Giri under consultancy administrations for plan and execution support for commercialization of National Waterway 1. As of late, without precedent for India's history, a compartment vessel was utilized for coordinations transportation on the National Waterways-1 along the River Ganga. A compartment payload having a place with PepsiCo (India) moved 16 holders of food and drinks from Kolkata to Varanasi. The IWAI vessel, MV Rabindranath Tagore, shipped 16 holders equal to 16 truckloads of food and snacks and came to Varanasi on November 12. It made its arrival venture with manures from IFFCO.

Fig.2.3 First ever Container Movement Through NW-1



Source: Inland Waterway Authority of India Website

2.4.2 Development of Tourism

Inland vacationer vessels – RV Bengal Ganga, Ganga Voyager-I and Ganga Voyager-II of M/s Heritage River Cruise Pvt. Ltd., ABN Rajmahal and ABN Sukapha of M/s Assam Bengal Navigation Co. Pvt. Ltd. are handling on NW-1 in the State of West Bengal, Jharkhand, Bihar, and Uttar Pradesh since numerous years on an expanding pattern. The developments of these vacationer's vessels with outside sightseers were kept during 2018-19 and finished their business trips effectively according to plan. One hundred seven (107) no. to and fro journeys between Kolkata to Hazardwari/Farakka and six (06) no. to and fro journeys between Kolkata to Bateshwarsthan/Munger/Patna has been performed by these vacationer's vessels. UP Chief Minister Yogi Adityanath has introduced a five-star extravagance journey transport on Ganga. Being worked by Nordic Cruise line, the twofold decker 2,000 sq. feet extravagance pontoon has a seating limit of 125 travelers. The name of the voyage vessel in Alaknanda Kashi.

Fig. 2.4 Tourist Vessel Alaknanda Kashi on NW-1



Source: Economic Times

2.5 Infrastructure on NW-1

Jal Marg Vikas project involves the development of various components for capacity augmentation of NW-1. Some of these components are already planned and being implemented, some are at the initial stage of planning and some are yet to be planned. Details of all such components are given below-

2.5.1 Planned Infrastructure

- Multi Modal Terminal sites at Haldia, Sahibganj & Varanasi.
- New Lock at Farakka.
- Bank Protection and River Training Works at existing and planned civil interventions.
- Maintenance dredging for maintenance of waterways and proposed civil interventions/navigation infrastructure.

2.5.2 Description of Infrastructure

- **Brief on Haldia Terminal**

The venture includes the improvement of an inland water terminal at River Hooghly (NW-1) proposed to be situated at Haldia modern territory, close Durgachawk, Hada, District Purba Medinipur, West Bengal. Geological directions of the focal point of site are 22°03'38.34"N and 88°08'29.49"E. Waterway Hooghly streams South way of the terminal site. Terminal site is very much associated by the streets. Site is associated with NH-41 through 7 m cleared street North way. Durgachak Railway Station is around 06 km away from the site towards North course and Haldia railroad station is around 12 km away towards west bearing. Closest Airport is at Kolkata which is around 135 km away from the site in the north course. Stream Hooghly in this stretch is traversable and neighborhood ships are at present working in the waterway for transportation of men and material. Inward streets of width 17 m and 10 m will be created at the undertaking site. The all out territory of the terminal site is 61.0 sections of land. The distinguished land has a place with Haldia Dock Complex. Site is a low lying area with elevation ranging from 4-9 m above mean sea level. It is required to fill the site to achieve a finished level of 7 m, i.e. 2.54 m above HFL. Soil required for filling is 3.3 lakh cum. The terminal facility is designed to handle 3.18 MTPA of cargo. Cargo comprises of fly ash, fertilizer, stone

aggregate, coal, edible oil & POL. These materials will be stored, loaded, unloaded and transported from the terminal site. Facilities to be developed at the terminal site include both onshore and offshore facilities. Onshore facilities include 16 nos. of silos for fly ash storage, stockyards for stone aggregates, fertilizers & edible oil/POL, internal roads, administration building, workers amenity building, lighting tower, power supply system, fire-fighting system, sewerage system, stormwater management system, waste management system and green belt (3 acres). Off-shore facilities include 4 nos. of berths & approach trestles and water approach channel. The proposed terminal project will be developed in phases, i.e. phase 1A & 1 B. Phase 1 A will comprises of all the proposed developments except 8 nos. of fly ash storage silos and its conveyors out of proposed 16 nos. of silos, stockyard development area (future storage) and railway siding.

Fig 2.5 Location map



Source: Environmental Impact Assessment Report, Ministry of Shipping

- **Facilities Available**

- Storage sheds (future storage area will be developed in phase 1B)
- 8 Nos. of Silos in phase 1A & 8 nos. of silos in phase 1B for flash storage and pipeline conveyor system
- Unloading & Loading Areas
- Internal Roads
- Berths (4 Nos.)
- Water area & approach channel
- Administration Building
- Workers Amenity Building
- Fuel bunker
- Security office
- Weighbridge building
- Lighting Towers
- Railway siding (future development)
- Other associated facilities like sewerage system, STP(Sewage Treatment Plant), dump pond, drainage system, RWH(Rain Water Harvesting) pond, fire-fighting facilities, communication system, water supply, ESS(Electrical Substations) & power supply.

- **Brief on Varanasi Multimodal Terminal**

A multimodal terminal is being developed at Ramnagar, on river Ganga in Varanasi district in Uttar Pradesh. Area of 5.586 ha has been acquired for the development of the terminal by IWAI and is in possession of IWAI. Identified site is open agricultural land. However, no agriculture activity is being carried out at the site at present. This Varanasi Multimodal terminal is going to be constructed in three phases, the deadline for phase I was 2018 and it got finished within the stipulated time frame. Phase II and phase III are projected to be finished by 2023. Under phase II and III, IWAI has planned to establish freight village near terminal which will have warehousing facility, consolidation/deconsolidation facility, packing facility and also railway connectivity from terminal to Jeonathpur Railway station which

comes under Mughalsarai Railway mandal. The proposed terminal project site falls in Ramnagar Municipal Board of Varanasi district. Photographs of the Varanasi terminal site are given below-

Fig. 2.6 Varanasi Multimodal Terminal



Source: Opindia.com

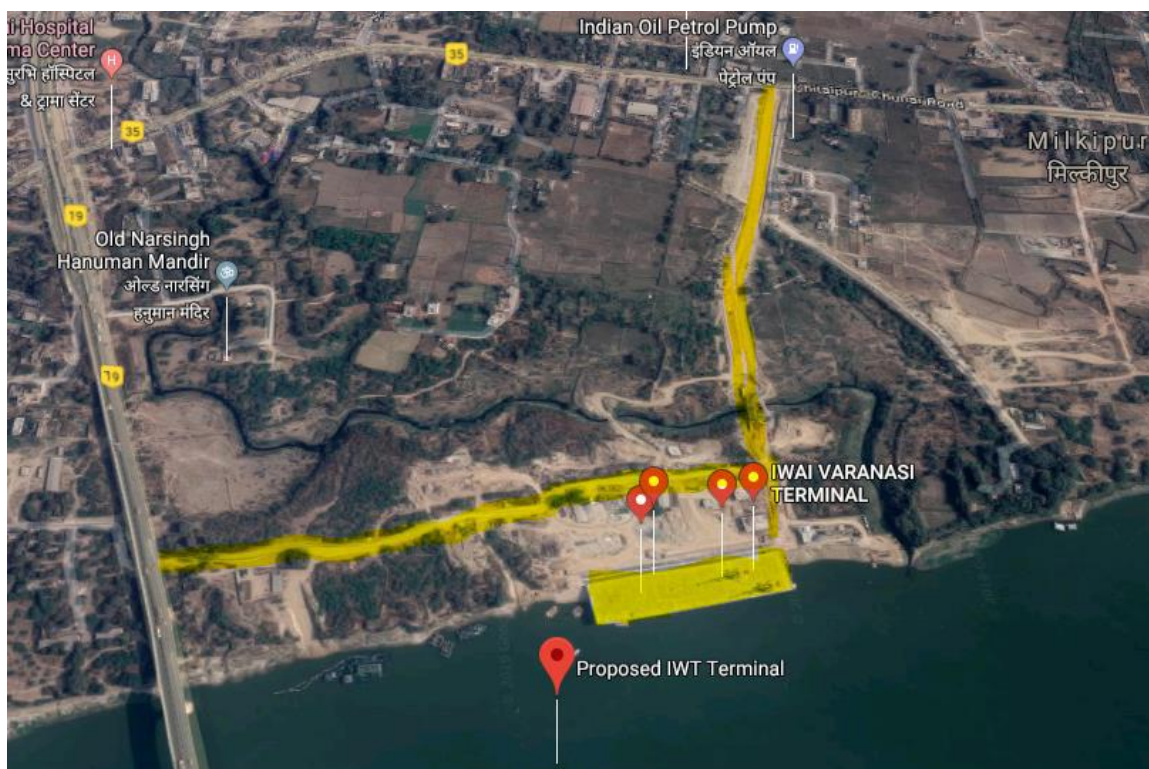
In expansion to this land, the zone of 1.415 is to be gained for development of access street to associate the terminal with NH-7. All out land prerequisite will be consequently 7.001 hectares. The Varanasi terminal is proposed to be created as a multimodal terminal office. The terminal site is agrarian land at present with a land spread including crops, mango plantations, and hardly any settlements. Site is a level land with height variety from RL +74-77m. Completed degree of site accomplished after cut and fill will be RL +75 which is more than the most noteworthy flood level, for example RL +74.

According to arranging, this terminal will be associated with the remainder of the city through streets and railroads both. At present site is associated by a town street. Approach street of 1 km length will be developed to interface the terminal site to NH-7 and NH-2. Railroad siding will be developed to furnish availability to the terminal site with the Eastern Dedicated Freight Corridor (EDFC). Inward street of 12 m width will be created.

within the terminal to facilitate smooth movement. In phase 1, the terminal shall handle about 0.54 MTPA (metric tons per annum) or 1636 tons per day (TPD). Material to be handled will be coal, cement, stone chips, and fertilizer and food grains, etc. Capacity will be enhanced to 1.22 MTPA by 2038. Onshore facilities for phase 1 include unloading/loading areas, internal

roads, administration buildings, substation building, toilet block, fuel bunker, security office, weighbridge building, lighting tower and other allied services sewerage management system, drainage system, fire-fighting facilities, communication system, water supply & power supply (ESS); Boundary wall, Green belt and Approach Road (1 km connecting to NH-7. Off-shore facilities for phase 1 include the construction of berth of 200 m length & 35 m width, Water area & approach channel and Shore protection (117 m upstream of the terminal and 35 m downstream of the terminal).

Fig 2.7 Location map



Source: Google Map

● **Facilities Available**

- 2 Nos. berths (100 m length & 36 m width each) so as 2 vessels of 80 m each can be berthed at one time.
- 2 mobile cranes for loading & unloading
- The open area at the site for storage of transportation material (Edible oil tank storage area)
- Passenger jetty (floating pontoons-20 m X 10 m) & gangway (1.2 m wide)

- Stone pitching upstream & downstream river bank (35 m length downstream & 117 m length upstream)
- Area for DGPS(Differential Global Positioning System)
- 12 m wide internal roads-365 m & 22 m wide internal road-650 m
- The approach road to NH-7 and NH-2
- ESS(Electrical Substations) 400 SQM building & power back-up
- Soak pit & septic tanks-wastewater management system
- Workers amenity building (30 sq. m.)
- Water supply system
- Stormwater drainage system
- Earthing & lighting protection system for all conducting materials
- Lighting system
- Green area

• **Brief on Sahibganj Terminal**

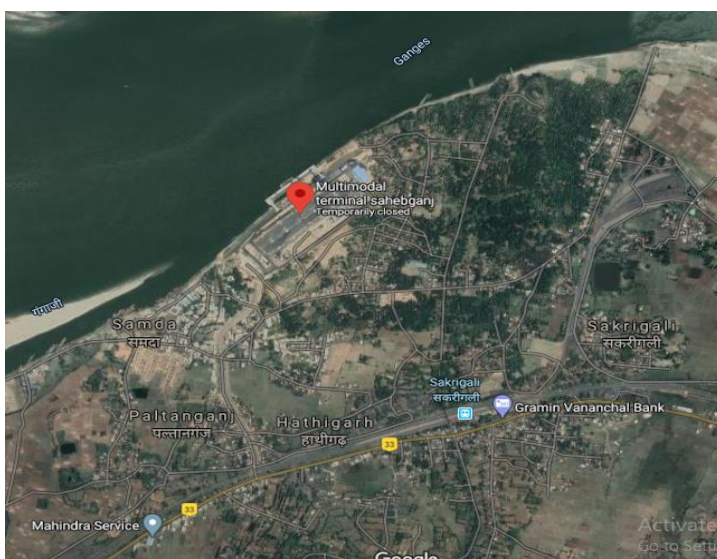
The Sahibganj terminal is developed as a multimodal terminal facility. The terminal site is agricultural land at present with a land cover comprising of crops, mango orchards, and few settlements. Site is highly undulating with ground level difference ranging from 30-56 m. a large quantity of cut & fill is required to achieve a flat surface. Approx.14.25 lakh CUM of soil is excavated, out of which 2.1 lath CUM will be re-used for filing. 12.1 lakh CUM of remaining earth will be re-used for road and railway construction. Finished level of site achieved after cut & fill will be 37.0 m AMSL (above Mean Sea Level) which is more than the highest flood level, i.e. 30.91 m AMSL

As per planning, this terminal is connected to rest of the city wide roads and railways both. At present site is not connected to any public road. An access road of 1 km is developed by PWD to connect the terminal with national highway 80. Railway connectivity will be developed by railways to connect the terminal site to Sakrigali railway station (Eastern railway corridor). Internal road of 12 m width and the total length of 3.6 km has been developed within the terminal to facilitate smooth movement. In phase 1, the terminal handled about 2.24 Million Metric Tons per annum or 6788 Tons per day. Material to be handled will be coal, stone chips, food grains, cement, fertilizers, and sugar.

Facilities to be developed at the terminal site include both onshore and offshore facilities. Onshore facilities for phase 1 include stockyards for coal (6 stockpiles), stone chips (8 stockpiles) & 1 covered shed; Unloading & Loading Areas; Internal Roads (12 m wide & 3.6 km length); Administration Building; Workers Amenity Building; Lighting Towers; Other associated facilities like sewerage system(Sewerage Treatment Plant), drainage system, fire-fighting facilities, communication system, water supply & power supply (ESS); Boundary wall of 2.4 m, Green belt- 15-20 m (2.9 ha), Approach Road (1 km connecting to NH-80 crossing LC-54) and Railway Connectivity (through Sagrakali Railway Station) with provision of ROB over LC-54 for approach road to be developed. Off-shore facilities for phase 1 includes Jetty (1 No.) & Berth (2 Nos.), Water area & approach channel, Turning Circle (2 Nos. at starting & end of the channel) and Shore protection (1.5 km. along River Bank).

During phase 1, 2 nos. berths, one for coal and one for stone chips / other cargo, are proposed to be provided in a length of 270 m. Berths are connected to shoreline/bank line by approach trestle (jetty) of 50 m length at its berth ends. Berth extends to another 25 m beyond the jetty into the river. After 50 m, available depth in the river for cargo varies from 7-11 m which is sufficient for cargo movement and will not require dredging. It is estimated app. 0.1 m CUM of maintenance dredging will be required annually during the operation and maintenance stage of the project.

Fig 2.8 Location map



Source: Google Maps

- **Lock at Farakka**

A navigational lock is a device used for raising and lowering ships/vessels between stretches of water of different levels on river and canal waterways. The existing lock gate at Farakka which has been operational since 1978, is old and inefficient. Since the modernization of the existing lock will entail closing down the lock gate for to 8-10 months, a new lock is proposed to be developed in Farakka on the Feeder Canal of Farakka Barrage adjacent to the existing lock at Farakka in Murshidabad district of West Bengal. A new lock will be further West to the existing lock and will share its right bank with the left bank of the existing lock. Site is located in village Goraipada, Grampanchayat Bewa, Farakka in Murshidabad district of West Bengal. The Ganga River is flowing about 1.2 km east of the proposed lock gate site. With the existing lock, it takes about 2 hours or more for a vessel to pass upstream or downstream of Farakka. With the new lock, it will take only 38 minutes for a vessel to pass through. If the movement of a vessel is followed by a movement of another vessel in the reverse direction, the operating time will be 23 minutes only.

The proposed undertaking would be set up in the 14.86 ha moved the place that is known for Farakka Barrage Project (FBP) and the land income zone demarked by Bela Mouza's, JL No. 31, Sheet No.3. According to the geological study completed at the site by IWAI, ground levels change from RL+13 to RL+29 m which show the site is practically level with a delicate slant. The lock entryway site is very much associated with street and rail. This street at by and by goes through the site and in this manner will be realigned to Western limit of the proposed lock door site. This street associates the NH-80 is situated about 1.6 km West of the proposed Lock entryway site and is associated.

The new lock like the current lock will encourage the development of vessels/canal boats from fundamental River Ganga upstream to River Bhagirathi-Hooghly downstream through feeder channel arranging the noteworthy contrast in water level existing in primary River Ganga and feeder waterway. The water level in the River Ganga and feeder trench differs as per the stream in River Ganga and the feeder channel. The new lock is required as the current lock isn't working enough and hinders the development of the vessels. The length and width (size) of the proposed lock is like the current lock. Length and width of the new lock will be 179.0 m and 25.148 m separately. A lock is intended to deal with four vessels of

size 85 m (length) X 12 m, (width) so as two vessels are secured the long way and two sidewise like a current lock.

Fig 2.9 Location map



Source: Google Map

- **Bank Protection and River Training Works**

Erosion of banks is a natural phenomenon in the alluvial rivers. However, erosion is aggravated due to the construction of any structure like bridge, terminal, and jetty on the river. Thus river training works include the engineering works carried out in the river to prevent the erosion of the banks, control and guide the river. It is proposed to carry out bank protection works of total 48.168 km. in the areas where erosion is observed and where civil interventions are planned to be carried out and details of the same are given below-

Table 2.1 Bank Protection Works-

S.No.	Location	Approx. Length(Km)
1	Varanasi	0.35
2	Sahibganj	1
3	Farakka Navigational Lock	0.75
4	Three New Terminals	2.5
5	Farakka Feeder Canal	9.5
6	Farakka to Tribeni	27.5
7	Barge repair and maintenance	2
8	Existing Terminals and Jetty	4.6

Source: Environmental Impact Assessment Report, Ministry of Shipping

2.6 Upcoming Facilities

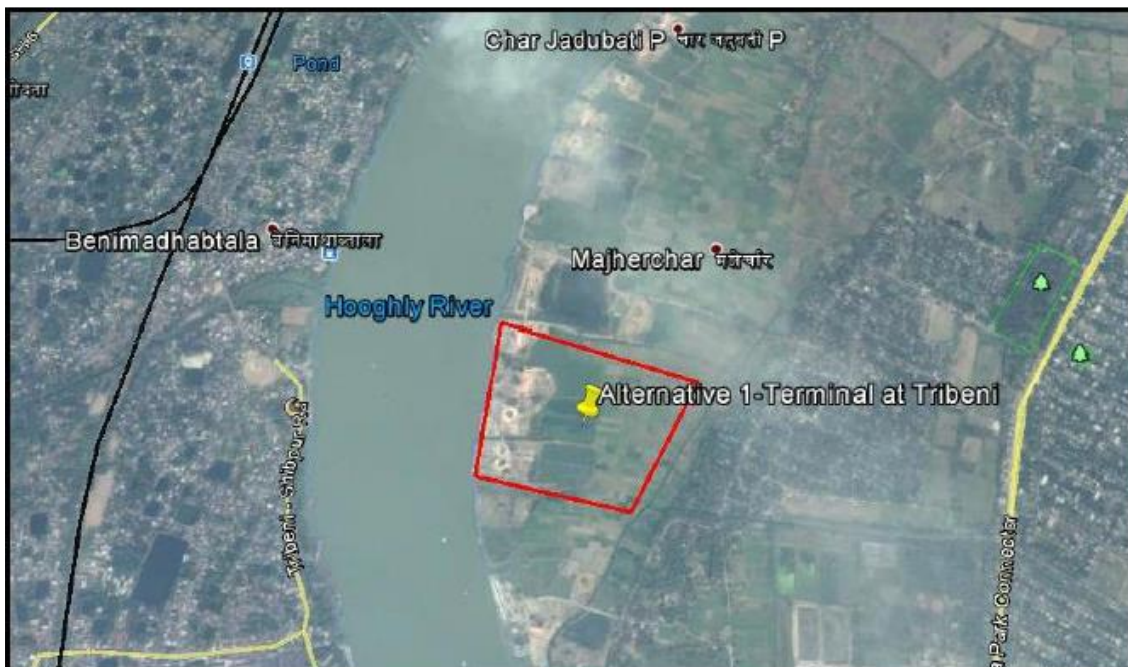
- One similar terminal site (Kalyani at Tribeni)
- 5 Nos. Ro-Ro Crossings and Passenger Ferry Jetties
- Development of low draught vessel
- River Training Works at Critical Locations like bends and civil interventions under planning Bank/slope & scour protection works
- Equipment of tow barges, inland vessels, survey vessels including rescue boats and survey equipment
- Barge maintenance and repair facility.

2.6.1 Description of Upcoming Project

- **Terminal at Tribeni -Kalyani (Tentative Location)**

It is planned to develop terminal at Tribeni. Planning is at the initial stage and site selection & finalization is undergoing at present. Two locations are considered for the development of the terminal. The first site is located on the left bank of River Hoogly upstream of Road Bridge on SH-6 at Tribeni, West Bengal. Site is well connected with road & railways. Kalyani Samanta is the nearest railway station. App. 40 ha of agricultural land is identified for the development of terminal at this site. Some brick kilns also exist at the site. One more site is considered for development of the terminal. Site is located on the right bank of the River downstream of the road bridge at SH-6. This site is located near the thickly populated area. Out of both the options alternative 1, i.e. site located upstream of SH-6 is considered for development of the terminal.

Fig 2.10 Location map



Source: Environmental Impact Assessment Report, Ministry of Shipping

- **Barge Maintenance & Repair Facility**

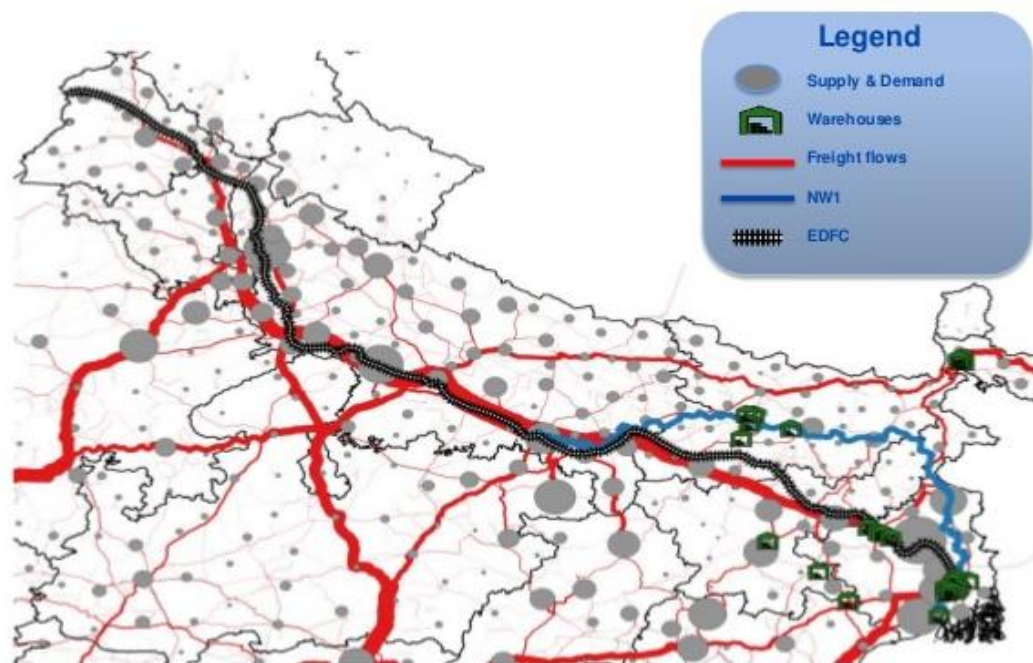
Barge maintenance and repair facility is an essential component of Jal Marg Vikas Project. At present no location has been finalized for the purpose but this development is under planning. Barge maintenance and repair facility will comprise of the following-

- **Slipway:** It is a ramp, which helps in moving the barge/ship to and fro from water to land. Slipway will be provided in deeper water conditions so as design vessels can be taken in docking conditions.
- **Winch House:** It should be provided in straight-line to the main slipway. It is generally a single room like structure and should have adequate space for winch and electrical equipment
- **Repair bay for large & small vessels:** Repair bay for vessels should be inclined so as the vessels can slide towards the river on its own after repair under control of winch.
- **Transfer bays:** To transfer small vessels between slipway and repair bay
- **Winches and trolleys:** Winches should be provided at winch house and at transfer bay. Trolleys should be provided to receive the vessels on the main slipway.
- Workshops and buildings with all basic utilities like water, electricity, stormwater management system and waste management system.

2.7 Connectivity and Accessibility

There are good rail and road connectivity at important places across NW-1 which enhances the utility of NW-1 for easy movement of cargo as well as material from one place to another in a most effective as well as efficient manner.

Fig 2.11 Connectivity



Source: Transport Report, World Bank Group

2.8 Conclusion

With the development of national waterways being an integral part of the Centre's plan to upgrade transport infrastructure in the country, work is afoot on National Waterway-1 (NW-1) linking Haldia to Allahabad. The ventures on the waterway Ganga will support the economies of West Bengal, Jharkhand, Bihar and Uttar Pradesh. The delivery service has at long last pushed the improvement of the Haldia-Varanasi stretch (1620 km) with ventures for development of multi-modular terminals at Varanasi, Haldia and Sahibganj, reinforcing of the waterway route framework, conservancy works, and advancement of data frameworks and night route offices, other than development of a navigational lock at Farakka.

Besides being cheaper to develop than railways and roadways, waterways cost 25-30 paise per km of transport, as against Rs.1 for railways and Rs.1.50 for roadways. From the alarming 3.5% at present, IWAI is aiming to increase waterway transportation of cargo in India to 15% by 2021. The Inland Waterways Authority of India (IWAI) has signed a contract with German company DST to design vessels suited to navigate the 1620 km stretch. If the project starts operating in full swing, this would be even low compared to countries like China, South Korea, UK, Germany, France where it is in the range of 35%-40%.

CHAPTER III

ISSUES, CHALLENGES, AND OPPORTUNITIES OF NW-1

3.1 Issues under National Waterway 1

It is notable that the suitability of Inland Water transport has consistently been a significant issue since the time elective modes like street and rail expected. Be that as it may, feasibility must be analyzed as far as various measurements. Numerous examinations have called attention to that a fundamental prerequisite as far as the water stream may not be met on the primary Waterway due to utilization of water for another reason particularly water system which has been made conceivable by damming, consequently cutting down the degree of standard stream. Further, the exorbitant cost engaged with standard digging may end up being a damper on such tasks however it is contended that this issue can be overwhelmed by defending the expense based on surveyed business development potential or the administrators getting ready for an increasingly practical draft of 1.5 meters.

These and numerous different issues lead to the significant issue of the modes operational suitability and in this way the effect on its money related execution. Given that it is a capital and scale-serious action and considering these qualities with the down to earth issues referenced over, the customary structure that is frequently remembered while talking about the advancement of the mode is not, at this point applicable. Such a structure continues with the rudiments suppositions that the mode has its points of interest just with regards to development of huge size transfers and over significant distances.

3.1.1 Cargo Movement

Movements of commodities like tea, jute, and spices in the eastern sector connected to the river port in Kolkata, was among the early commercial drivers of pre-independence India. Logistical convenience of river transport, which used to be a determining factor in the location of industrial activity may be less so today though access to water for processing and some cases efficient treatment is still a consideration in location. IWT based cargo movement becomes viable if technological and physical viability and the commercial potential exists and

operating policies of carriers and associated agencies are conducive. Some factor that affects operational economics are the availability of right-of-way (waterway), carriers (navigational vessels), terminal facility (jetties and ports), and managerial and supporting infrastructural systems.

3.1.2 Technological and Physical Viability

- **Water flow:** In the main waterways, water flow may have decreased over the year because of increased drawing on water arising from habitation and industrial and agricultural needs, Damming may have also have brought down the extent of regular flow.
- **River training, Dredging, and Navigational:** To consistently provide sufficient depth for plying drafts may require maintenance of banks and periodic riverbed dredging.
- **Navigational requirements:** Navigational requirements are channel markings, night navigational aids- including the possible deployment of global; positioning system (GPS)-and river maps and charts.

3.1.3 Commercial potential

Aggregate assessments of traffic have been made by the Ministry of Shipping. Freight handling in IWT involves movement to and from the water mode including loading and unloading of materials and storage. IWT offers medium batch size possibilities slow but secure movement limited door-to-door opportunities, and cheap rates. In comparison, the road offers small load options, faster movement, door-to-door service, but higher rates. Rail offers large batch economies, quick movement, partly door-to-door service, and medium rates. The geographical advantage of freight transport by IWT is strongest if the entire movement is across a river. For transport of material (construction material and equipment) relating to a particular river-based project activity (e.g. river bridges, hydroelectric plants), IWT is most attractive.

Custom from small customers with regular demand, based on agriculture or manufacture of commodities and meant for consumption or processing within the country or for the export, is slowly increasing, going by the estimates of CIWTC and others barge operators in NW-1. High-value movements, such as machinery and equipment on river-based projects, has also

proved a viable activity for bridge building. External trade through the oceangoing vessel provided customs formalities can be carried out without entering the port. The cost savings are likely to be significant.

3.1.4 Operational Viability

- **Cost:** IWT is a capital intensive industry. Significant investment is required in vessels. Providing and maintaining the waterway and terminals requires even higher investment. Operating costs can involve vehicle cost, fuel costs, maintenance costs, and loading/unloading costs. Contingency costs include running aground and damage the vessels.
- **Fleet Planning:** barge operations rely on economies of scale. Larger barges require larger water depth, have lower operating costs but higher inventory staging costs. They may also have an operating restriction. Small barges, on the other hand, may congest traffic. A range of sizes offers a better choice.
- **Scheduling:** Scheduled runs have advantage of certainty to customers, routine vehicle deployment and control of Operational Cost.

Regarding Operational viability, barge economy is capital and scale-intensive activity. The preferred barge size in NW-1 is about 1500-2000 tons. There has been insufficient draft of vessel hence it has operated below capacity. In Contrast to Other Nations like US, EU, China and many Asian Countries, transportation by Inland Waterways is highly Under developed in India.

3.2 Key Concerns of National Waterway 1

- The fishing community raised concern regarding the effect on fish productivity and demanded support for the same.
- Provisions should be made for land acquisition wherever applicable.
- People desired to have the relocation site for the people likely to displace near the river Ganga.
- People demanded support for the improvement in and around local immersion Ghats at Durgachak (near Haldia terminal in West Bengal) to reduce congestion, especially during the local festival.
- People raised concern that the terminal development may lead to increased traffic on the connecting roads which are not suitable for such an increased load and needs to be upgraded.
- Turtles will be affected due to the regular movement of vessels in Ganga River in kasha Turtle Sanctuary.
- Dolphins will be affected due to the barge movement during the operation phase of the project.
- Oil spillage from ships during an accident may impact the aquatic flora, fauna, water quality and anti-bacterial properties of river Ganga.
- People raised concern regarding the likely impact on water quality due to terminal facility and cargo movement.
- People raised concern about cutting of large no. of trees at Sahibganj site.
- The varying LAD may lead to the grounding of vessels.
- Dredging may have a significant impact on breeding and spawning season of fishes.
- People have pointed out the existing erosion problem in the Farakka feeder canal and voiced the apprehension that the NW-1 development and barge movement may escalate this problem.
- People have suggested that appropriate parking facilities be made inside the proposed terminals for better management of goods carriers and to reduce traffic on the existing road due to inappropriate parking on the public road.
- People have proposed adequate provisions for prevention of water logging in and around the terminal and for firefighting.

3.3 Challenges for National Waterway 1

When it comes to the implementation of Jal Marg Vikas Project to ensure navigation in entire NW-1 throughout the year, various challenges come in the picture. NW-1 is an alluvial river with typical characteristic of braiding, meandering and large water level fluctuation between summer and monsoon months. Wide variations in water level are observed ranging from 2.5 m at Farakka to 16.5 m at Allahabad. Current velocity varies between 0.2m/s during lean season to 4.0 m/s during flood season in the stretch between Allahabad to Farakka. Current velocity is 1.2 m/s in Feeder Canal & 1.7 m/s (max.) in Bhagirathi river stretch. Ganga carries annual silt load of 1600 million tons. Fine silt leads to rapid shoal formation. It becomes difficult to maintain even 2 m depth during low water season throughout the stretch. The stretch between Haldia and Tribeni (196 km) is tidal and the Least Available Depth (LAD) of more than 3.0 m is maintained naturally therein. IWAI has to erect bandals and carry out dredging to maintain the LAD in upper stretches of Tribeni. Due to unavailability of adequate depth/width and navigational infrastructure facilities, navigation of the large cargos throughout the year is possible only after the proper dredging and regular draft maintenance. There is one more challenge in front of National Waterway 1 and especially between Sahibganj and Varanasi is that cargo availability. Feasibility study of this project has already been conducted and it is proved feasible by the World Bank but the main challenge is to make this mode available to a maximum number of traders and bring the maximum number of cargo from them.

India's inland water transport sector is relatively underdeveloped compared to other large economies due to a 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. Major challenges for navigation in NW-1 are listed below-

Fig. 3.1: Challenges / Key Issues



3.3.1 Technical Challenges

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

- **Inadequate depth:** Large parts of Indian waterways have the 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 commercially viable through economies of scale. Moreover, Indian rivers (especially in the northern plains) face severe problems of siltation around the year. The river bed rises, impeding the movement of cargo during non-monsoon months. Inland Waterway Authority of India is working on this challenge and dredging between Haldia to Allahabad is happening in a very intense manner.
- **Inadequate air draft:** Multiple bridges with low vertical clearance obstruct the passage of bigger inland water transport vessels on waterways. 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 Brahamani. But these cannot be utilized for cargo movement due to air draft restriction.

- **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.
- **Lack of Terminals:** Including those with inter-modal connectivity on inland waterways inhibit door to door connectivity to end user.
- **Lack of night navigation infrastructures:** Lack of Night navigation facilities such as DGPS and RIS. Nonavailability 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.
- **Shortage of MRO Facilities:** There are a severe shortage of MRO (Maintenance, Repair, and overhaul) facilities for inland water transport vessels. In case of any vessel breakdown situation, it needs to be towed for a long distance for repairing and maintenance. That is why an adequate number of repair and maintenance facility should be constructed along with the Ganga.
- **Integration:** Integration of river basins to ensure year-round navigability: a strategy to mitigate seasonality of water availability & siltation.

3.3.2 Regulatory Challenges

- **Modal Integration:** Modal Integration and Related frameworks advancement. Absence of potential multimodal hallways and definite planning of Waterway and mechanical groups, multimodal transport center points in the inland water transport passageway. There is a need to create feeder courses on the Waterway under the ward of the state to national Waterway with the goal that the whole channel can be created on the "fishbone structure". Just as the need to incorporate the inland water transport with beach front transportation activities so as to coordinate and oblige hinterland seaside and global sea traffic.
- **Operation and Maintenance:** Operation and Maintenance of fairways and related infrastructure for private participation to achieve accelerated development. Needs to implement the river information systems on waterways.
- **Policy parity:** The administration needs to build up a level playing field between the different vehicle modes. While inland water transport is cost serious all in all with other vehicle modes, for example, rail and street, the circumstance is once in a while contorted by special treatment offered to different modes. A model is cargo transportation for manure being stretched out to rail and street yet not to inland water transport. This misleadingly makes rail and street progressively serious on the cost bend and drives traffic away from inland water transport street and rail additionally appreciate special duty treatment.
- **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 need to have the uniformity for followed up by the adoption of various states.
- **Restructuring:** Restructuring of inland waterways authority for further efficient operations of development maintenance and regulation of fairways and navigational infrastructure, effective utilization of fairways.

3.3.3 Geo-Political Challenges-

- **International Protocols:** A universal conventions course is giving the immediate linkage of Haldia and Kolkata ports with landlocked northeastern states and can possibly be used as the principle mode for transportation of load from northeastern area to Kolkata and Haldia other than upgrading exchange with Bangladesh. The vitality productivity of Waterways gets invalidated by the higher turnaround time of the freight ships because of the authoritative and operational postponements along the convention course.
- **Cross Structures:** Construction of dams/barrages to increase the depth of navigational channel faces challenges of economic viability. The multipurpose hydro projects planned for the long term perspectives are needs to ensure the interest of navigation.
- **Inter Linking of Rivers:** The river inter-linking projects are ensuring to use as waterways for navigation. The Inland water transport has strategic importance for connectivity of northeastern regions which do not have very efficient connectivity due to its geographical position and rail/road transport passing through the “Chicken neck”.

3.3.4 Financial Challenges

- **Investments by Governments:** There has been underinvestment in inland water transport sector infrastructure vis-a-vis road and rail. While considerable emphasis has been laid on the 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.
- **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 another transport sector like road and metro rail.
- **Capacity building:** There is a 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.

3.3.5 Environmental Challenges-

Ecological effects have been surveyed thinking about the present ecological setting of the undertaking region, nature, and degree of the proposed exercises. An appropriate subjective and quantitative methodology was followed for recognizable proof of likely effect on each worth parts of condition for structure, development and activity stage. The expanded drawing of water for drinking, water system, development, and other action decreases the general progression of water in downstream districts and makes transport tasks troublesome. Dams additionally hamper smooth vehicle. Here we will discuss various environmental which National Waterway 1 is having-

- **Impacts on water quality and land due to dredging operations:** Impacts of dredging on water quality are an increase in turbidity; reduced light transmittance; reduced dissolved oxygen, changes in salinity, temperature, pH & concentration of nutrients and release of heavy metals/chemicals. As per one study, dissolved oxygen level comes down suddenly by 2 to 2.5 mg/l for a maximum of two minutes only at the dredge plume arrival point which is regained within 3-4 minutes as the plume passes. Turbidity of water also increases substantially close to dredging point but it reduces with distance and almost gets normal at a distance of 700m from dredging point. Land disposal of sediments is anticipated only when sediments are contaminated and in the case of Haldia terminal dredging. When the dredged material is disposed on land in the form of a slurry, excess water drains back to the water body which can affect the water quality.
- **Impacts on water quality due to barge operations:** Vessels generate garbage, oily waste, sewage, bilge water & ballast water which can affect the water quality of the river. Usage of anti-fouling paints may also impact the water quality as the paints may contain toxins. Settling of the dust of the material transported on river surface again can impact the river water quality. Ship accidents/collision may lead to spillage of the commodities transported including oil which may impact the water quality of the river.
- **Impacts on Riverbank & Riverbank structures due to barge operations:** Wave generated due to vessel movement may lead to bank erosion. Impacts are anticipated

to be minimal except at the feeder canal near Farakka which is narrow and has erodible banks.

- **Impacts on Air Quality due to dredging and barge movement:** Barges also generate emissions but this is far less as compared to road and rail for transportation of the same quantity of cargo for the same distance. In the form of dust which is being generated from the movement of material, dredging activity, and emission from the vessels whose engines are properly maintained, the environment is getting affected but the amount is less in comparison to other modes of transportation. Thus impacts on air quality are anticipated to be positive.
- **Impact on Aquatic Ecology due to maintenance dredging:** Impact of dredging on aquatic ecology include change in diversity of benthic habitat, impact on behavioral response and tissue injury of aquatic organism due to increased noise levels, blocking of fish gills due to increased sediments, intake of toxic pollutants by aquatic fauna as released during dredging, smothering of benthic flora & fauna due to dredge disposal and loss of Submerged Aquatic Vegetation (SAV) are some of the major issues arising due to various activity in Ganga. Due to such consequences, no dredging operations are proposed within or in the vicinity of Kashi Turtle Sanctuary and Vikramshila Gangetic Dolphin Sanctuary (VGDS) that minimize the possibility of the impact of dredging on such vital sensitive organisms. But in another way, it is slowing down the process of dredging in this area which is very much inevitable to maintain a certain level of the draft for the vessel movement.
- **Impact on aquatic ecology due to barge operations:** Impact of barge movement on aquatic ecology can be due to speeding vessels, spillage of material transported (oil majorly) and generation of high-level underwater noise. Vessels if moving in high speed can collide with aquatic organisms leading to mortality and injury to aquatic organisms. Spillage of material transported can impact the habitat of the aquatic species. Oil spills are most significant among all spills as oil can form a layer breaking contact between water and air and reducing dissolved oxygen level, block gills and skin pores of aquatic organisms leading to mortality.

3.3.6 Challenges in Integrated Project Development

- **Long Term Cargo Commitment:** There will be a shortage in long term cargo commitment for the economic stability of sustainable operations in the waterways.
- **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 the normal budget for developing the missing infrastructures.
- **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.

Factors affecting the diversion of waterways Traffic:

- Type of commodity
- Volumes to be handled
- The actual place of origin /destination
- Long Term Commitment to Traffic
- Distance from terminal
- Existing Modal Choice (Rail/Road)
- Port – Waterways Connectivity
- Comparative Intermodal distance
- Water Transport Trip (O-D) Distance
- Empty Return Ratio
- No. of users at the terminal (captive or multipurpose)
- Deep sea transshipment, wherever feasible

3.4 Opportunities

- **Vessel Making Industry:** Due to the expansion of National Waterway 1, there is huge potential for boat/vessel making industry between Haldia to Allahabad. There is 'N' number of artisans who are engaged in making and repairing boats and ships in Kolkata but they are not constructing vessels having 1500-2000 DWT. Today only IWAI ships are operating in Ganga but there is a huge opportunity for a private party to invest in vessel making industry. It will not only increase the number of the vessels but also provide employment opportunities to local people. Along with vessel construction, there is potential in inland water transportation equipment manufacturing industry, repairing and maintenance industry and so on.
- **Enhancing economic opportunities / Employment:** Water transport is important for direct employment, such as boat building and fishing livelihoods, as well indirectly, allowing poor people to access employment in the cities while living in less expensive locations. Increased mobility also plays a key role in supporting livelihoods by providing rural producers, such as farmers and fishermen, a means to access their end-markets. For example, in Bangladesh some four million people are thought to earn their living transporting foods and passengers along the country's waterways, providing an estimated 60% of all employment in the transport sector. IW transport will provide more job opportunities for marine floating staff due to increase in the number of the fleet, for port and harbors operation Executive port directors who can oversee the administration, operation, and maintenance of an inland port.
- **Trade prospects along the India-Bangladesh protocol route:** The next best opportunity which we can identify under the National Waterway 1 is that its optimum utilization can help India to increase its trade relation with Bangladesh. As we all know that National Waterway 1 stretches from Allahabad (Uttar Pradesh) to Haldia (West Bengal) which share its border with Bangladesh, and also India has another waterway project called National Waterway 2 which will pass through Bangladesh and connect North Eastern states of India with rest of the State of India. Both NW 1 as well as NW 2 have the potential to enhance our trade relation and cultural diversity with Bangladesh. Today the trade figures with Bangladesh via National Waterway are not very intense but with the help of proper roadmap and clear vision toward Inland Waterway movement, we can expect a good amount of trade with Bangladesh.

- **Cargo from Nepal if connected to waterways can increase the traded Volume:** For more bilateral trade between India and Nepal (landlocked country), National Waterway 1 can prove as a milestone. Uttar Pradesh Share its boundary with Nepal and by using National Waterway 1 Nepal can enhance its trade volume with India. The current scenario is that just because of Nepal is a landlocked country, most of its cargo is being handle at Haldia port and from there, it is being moved from one place to another. National Waterway 1 can reduce the time from Haldia to Nepal and vice versa.

3.5 Conclusion-

If we classified all the movement of cargo in India by different modes of transportation then we will find that major portion of movement of cargo is being done by the road (60%) which consist National highways, State highways, etc., followed by rail (32%) which is next most used mode after road, and followed by Coastal (6.6%), then Air (1%) and last is Inland that is (0.4%). Eventually the motive behind this “Jal Marg Vikas Project” is to increase the share of inland movement of cargo because this mode is comparatively cheaper, safer, environmentally friendly, and convenient in comparison to other modes of transportation.

Cargo movement exists at present also in NW-1. 27, 16,436 MT of cargo (15, 11,961,380 TKM/1.512 BTKM) was transported via NW-1 during 2012-2013 (IWAI). Cargo transported include cement, fly ash, iron ore, iron ore fines, coal, steel shed, tyres, iron fines, iron ingots, Galvanized steel plain sheets, stone chips, furnace oil, high Speed diesel, lube oil, boulders, pulses, aluminum block, sand, chips, ship block, log, pulses, Manganese ore, Petroleum, Coke, Cooking coal, Rock Phosphate, Timber, Peas, Slag oil, and Non-cooking coal. An Indo-Bangladesh Protocol on Inland Water Transit & Trade also exists between India and Bangladesh apart from inter country water transport. Under Indo-Bangladesh Protocol, inland vessels of one country can transit through the specified routes of the other country. The existing protocol routes are Kolkata – Pandu-Kolkata, Kolkata-Karimganj–Kolkata, Rajshahi-Dhulian-Rajshahi, and Pandu-Karimganj-Pandu. For Inter-country trade, four ports of call have been designated in each country, namely; India –Haldia (West Bengal), Kolkata (West Bengal), Pandu (Assam), Karimganj (Assam) and Silghat(Assam) and Bangladesh-Narayanganj, Khulna, Mongla, Sirajganj, and Ashuganj. Cargo traffic and the commodities transported in NW-1 vary in different stretches.

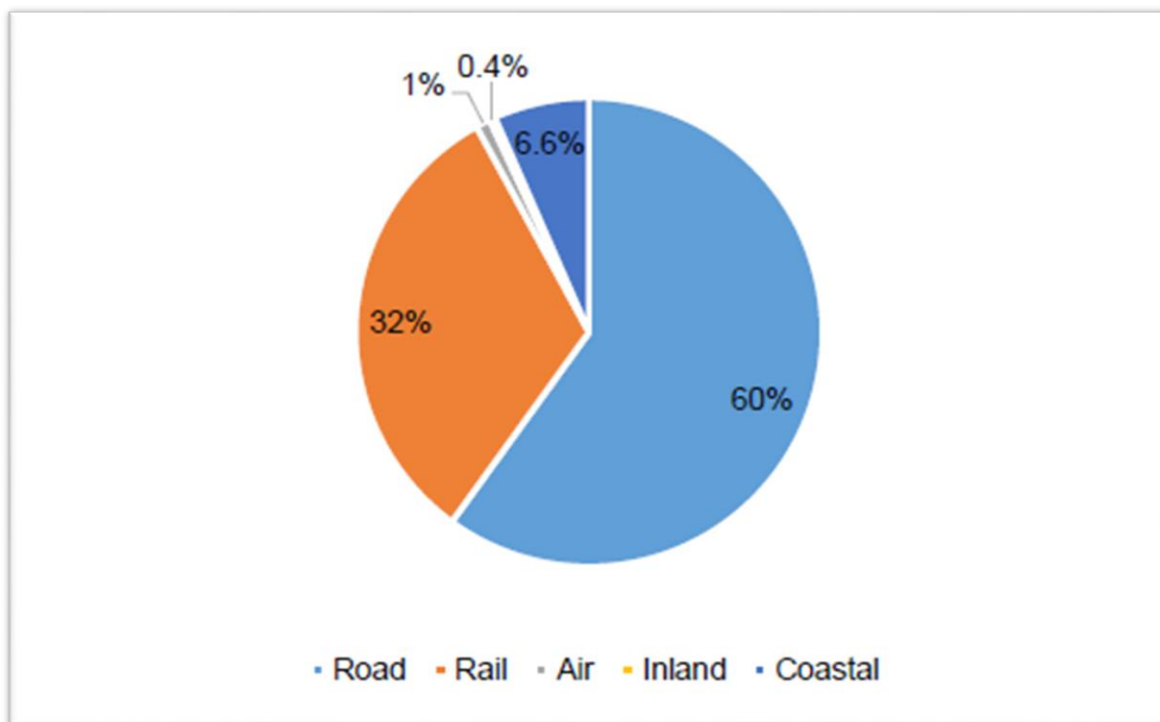
CHAPTER IV

IMPACT OF NW-1 ON TRANSPORTATION INDUSTRY

4.1 Introduction

In the event that we order all the development of load in India by various methods of transportation then we will locate that significant part of development of freight is being finished by the street (60%) which comprise National roadways, State highways, and so on., trailed by rail (32%) which is next most utilized mode after street, and followed by Coastal (6.6%), at that point Air (1%) and last is Inland that is (0.4%). Eventually the motive behind this “Jal Marg Vikas Project” is to increase the share of inland movement of cargo because this mode is comparatively cheaper, safer, environmentally friendly, and convenient in comparison to other modes of transportation.

Graph 4.1: Model Cargo Share of India

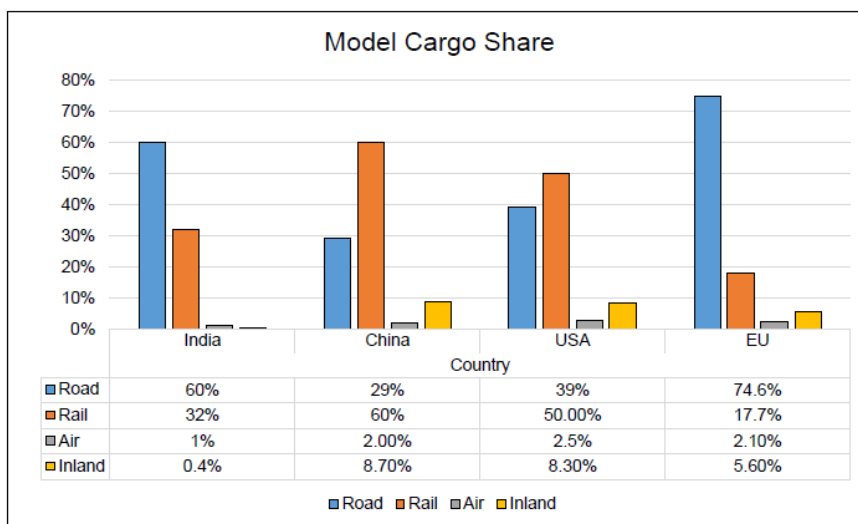


Source: The Times of India News

The above pie chart shows the logistic scenario of India, but As compared to other large countries like the United States, China, and the European Union, Freight transportation by

waterways is highly under-utilized in India. The total cargo moved (in ton-kilometers) by the inland waterway was very less of the total inland traffic in India, compared to the 21% figure for the United States. Indian water transportation is receiving significant attention in recent times since logistics cost in India is one of the highest among major countries –as per the reports it is 18% in India versus 8-10% in China and 10-12% in European Union. When we compare the Indian scenario with the other Developed Country then the result are totally different, some country emphasized more on road transport, some are on Rail, and some are on Inland/Coastal. Here we are going to some comparative study between India, China, United States of America, and also we will discuss Inland Waterways Scenario in Thailand and Bangladesh. Form this analysis we will try to figure out what are the things India should learn from another country.

Graph 4.2: Comparison of India and selected Countries in Cargo Movement



Source: Report, Sustainable Development of inland waterway transport in China

North America: In the United States with its water transport infrastructure over the Missouri-Mississippi and the inter-coastal traffic, together with accounts for over 630 million tons of cargo per annum. Freight movements by IWT on the Great Lakes and the Mississippi continue to be important modes.

Europe: IWT is estimated to carry about 7% of freight traffic which in fact is in a growing stage in the European Union (EU) states. The Rhine and the Danube are major IWT Rivers in Europe. A network of 30,000 km of waterways linking the North Sea to the Black Sea carried 425 million ton in the EU.

Thailand: IWT is estimated to transport about 20 million ton of cargo annually, representing 4.5% of total inland cargo volume better than rail, which has a share of only 1.9%, and well below the road, which has a commanding share of 96.6%.

China: IWT accounts for almost 10% of the total freight tonnage carried in the country, and for that, two third is carried on the Yangtze River (including bulk cargo like coal, steel, cement, containers, and LPG).

Bangladesh: Inland waterways are estimated to carry approximately 14% of the country’s annual passenger’s volume and about 35% of its annual freight volume.

4.2 Cost comparison among different modes of Transport

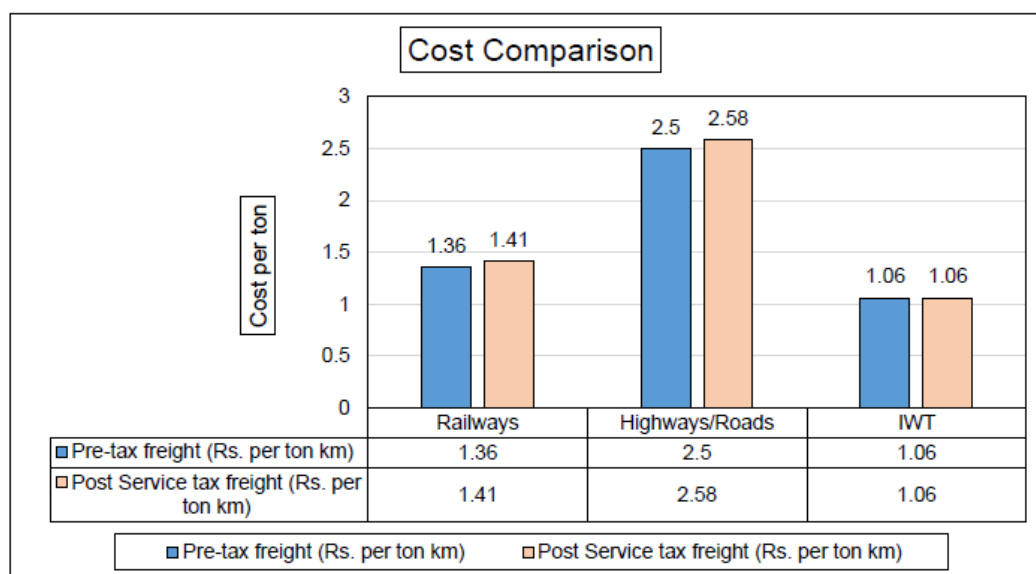
As per the RITES Report on Integrated National Waterways Transportation Grid (INWTG) the Cost comparison between Inland Water Transport (IWT) mode and rail and road transport is given below.

Table 4.3: Cost comparison between IWT mode, rail and road transport

Mode	Pre-tax freight (Rs. per ton-km)	Post Service tax freight (Rs. per ton-km)
Rail	1.36	1.41
Road	2.50	2.58
IWT	1.06	1.06

Source: RITES Report

Graph 4.4: Cost comparison among IWT mode, rail and road transport



Source: RITES Report

Thus, in theory, every kilometer that a ton of cargo moves on the water can save Rs. 1.52 as compared to the same cargo moved on road and Rs. 0.35 if the same cargo was moving on the rail. But the cost of transport is only one aspect. There are several other aspects that constitute the advantages (or disadvantages) of any mode of transport. On the one hand, road is the comparatively costlier mode of transport when vehicle operating costs alone are compared, but it has an edge over other modes i.e. rail and IWT, as road transport offers door to door services, reducing local terminal costs. Similarly, rail has its own operational advantages of carrying bulk cargo on longer leads.

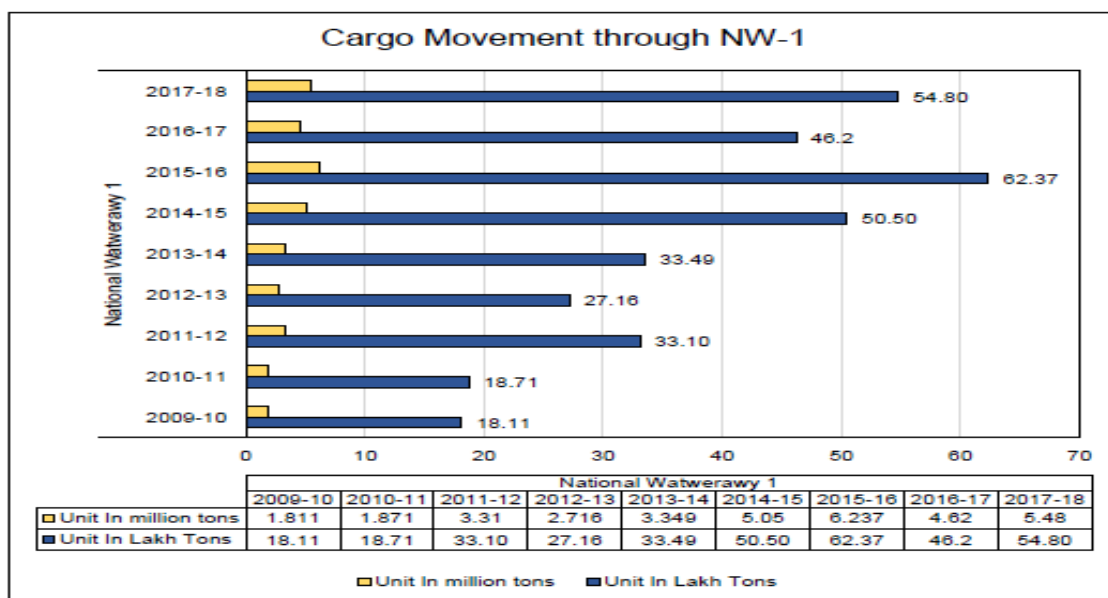
4.3 Present and Projected Cargo at NW-1

Cargo movement exists at present also in NW-1. 27, 16,436 MT of cargo (15, 11,961,380 TKM/1.512 BTKM) was transported via NW-1 during 2012-2013 (IWAI). Cargo transported include cement, fly ash, iron ore, iron ore fines, coal, steel shed, tyres, iron fines, iron ingots, Galvanized steel plain sheets, stone chips, furnace oil, high Speed diesel, lube oil, boulders, pulses, aluminum block, sand, chips, ship block, log, pulses, Manganese ore, Petroleum, Coke, Cooking coal, Rock Phosphate, Timber, Peas, Slag oil, and Non-cooking coal. An Indo-Bangladesh Protocol on Inland Water Transit & Trade also exists between India and Bangladesh apart from inter country water transport. Under Indo-Bangladesh Protocol, inland

vessels of one country can transit through the specified routes of the other country. The existing protocol routes are Kolkata – Pandu-Kolkata, Kolkata-Karimganj–Kolkata, Rajshahi-Dhulian-Rajshahi, and Pandu-Karimganj-Pandu. For Inter-country trade, four ports of call have been designated in each country, namely; India –Haldia (West Bengal), Kolkata (West Bengal), Pandu (Assam), Karimganj (Assam) and Silghat(Assam) and Bangladesh-Narayanganj, Khulna, Mongla, Sirajganj, and Ashuganj. Cargo traffic and the commodities transported in NW-1 vary in different stretches.

The below graph has a very significant message which describes how much potential Inland Waterways are having in India. In this Graph, we have taken data from the year 2009-10 to 2017-18. After the complete analysis of this graph, we can say that there is subsequent growth in the Movement of cargo in the National Waterway 1. If we see the year on year growth between the year 2009-10 to 2017-18 then we can see a massive growth rate that is 203%, in nine-year, a growth percentage of 200 percent is not a small achievement for Inland Waterways Authority of India. And the point which IWAI should take into consideration is how to harness this Inland Waterways in the best possible manner.

Graph 4.5: Cargo handled by National Waterways 1



Source: Inland Waterway Authority of India

4.4 Impacts on Stakeholders of National Waterway 1

Different stakeholder of National Waterway 1 is going to be affected in a different manner after the full-fledged operation of “Jal Marg Vikas Project”. Prior to understanding its effect, we should contemplate all the partner so we can isolate the partner in three-section or we can say that there is three significant partner of National Waterway. The first is Shipper/Consignee/Users, the subsequent ones is vessel administrator and the last yet not simply the least, IWAI. Shipper/clients may comprise of the different party who are straightforwardly or in a roundabout way utilizing Inland Waterway, some are giving their administrations to this venture like upkeep and fixing office, materials, and so forth., and some are utilizing it for bringing in and sending out. So we will talk about them in a point by point way. The following partner which will be influenced by this sublime venture is different vessel working association.

4.4.1 Impacts on Shipper/Users

- **Reduces cargo transit time:** After the successful implementations of Fairway improvement and maintenance in National Waterway 1, the Shipper and the various users can expect a reduction in their cargo transit time which save both their time as well as money, so by fairway improvement and maintenance, shipper and users are going to be benefited.
- **Increased service reliability:** Due to the proper facility of fairway and maintenance facility, reliability of shipper and users will be enhanced which will bring more cargo movement from their side and by this way, trade volume will increase from Inland Waterway and logistic cost will decline.
- **Enhanced availability and reliability of fairway:** Bank protection works at selected locations are one of the key work which is being happened in some areas which are going to enhance the availability of the services and increase the reliability of the users.
- **Reduced delays at lock:** Rehabilitation of existing lock and installation of the new navigational lock at Farakka will help the users of national Waterway 1 to reduced delays at locks.

- **Increased reliability of shipping services:** Rehabilitation of existing lock and installation of the new navigational lock is not only helpful in reducing delays at the lock but also increase the reliability of shipping services for the users of National Waterway 1
- **Reduced cargo loss:** Due to the proper facility of stowing of cargo in the terminals, proper storage facility of cargo, the risk of loss of cargo is reduced very significantly. Now the Exporter/Importer are relaxed enough to trade through national Waterway 1.
- **Increased frequency of service:** Cargo terminals with the appropriate equipment are increasing the frequency of the services because eventually, the better handling of cargo is reducing cargo handling time which ultimately reducing the turnaround time of the vessel, due to this, number of services is being called at the various terminal of National waterway 1.
- **Reduced cargo dwell time:** As we have mentioned above that with appropriate equipment in cargo terminal, reduction in the cargo loss, as well as increment in the number of the services, are happening. But along with these impact, there is some other advantage of the appropriate equipment and that is it will reduce the dwell time of cargo inside the terminal.
- **Increased service availability and reliability:** Inland Waterway Authority of India has invested in the infrastructure like Navigational aids including River information system, incident management systems, etc. because of such infrastructure the availability and reliability on services has increased which is benefitting Shipper/users.
- **Greater competition in services:** Inland Waterways Authority of India along with the World Bank is emphasizing more on creating improved investment climate for the private sector. By highlighting the viability of the project, IWAI is trying to attract number of private people which will help to increase the competition in services and due to which the Shipper/Users will have more number of options.
- **Reduced costs:** As we all know that the number of private people will be in the race, the more will be competition, the more will be an option for shipper/users and this completion brings perfect competition in the sector which will automatically reduce the cost.

- **Increased efficiency:** In perfect competition, the reaction of one party is determined by the action of another party which increases the efficiency of either party and this would be very helpful from the point of view of the shipper/users. The more the rivalry in the sector, the more will be the efficiency in the services.

4.4.2 Impacts on Vessel Operators

- **Increased vessel usage:** At the point when we talk about the vessel administrators appended to the National Waterway 1, we can say that the use of vessels has expanded altogether in contrast with the past status. The primary explanation we can recognize is fairway improvement and support in National Waterway 1. Because of ceaseless venture by Government on the improvement and upkeep take a shot at NW 1, the productive result has begun coming as expanded vessel utilization.
- **Increased vessel size:** Improvement and maintenance facility in National Waterways not only increased the usage of the vessel but also increased the size of the vessel. Better infrastructure motivates shipper as well as other users to increase the volume of the cargo and that increases the supply of the vessel from the vessel operator side. To achieve economies of scale the vessel operators have started increasing the size of the vessel.
- **Increased vessel utilization:** Due to bank protection works at selected locations along with National Waterway 1, the optimum utilization of vessels has achieved. Before proper facility, it was very much difficult for vessel operators to run the vessel, but as soon as the significant work being done at the National Waterway 1, the vessel utilization has increased.
- **Reduced vessel delays and increased vessel usage:** Rehabilitation of existing lock and installation of the new navigational lock at Farakka and various other places reduced the vessel delays and also increased the vessel usage in a most efficient and effective manner.
- **Reduced vessel time in terminal:** Another significant impact on the vessel operators are in the form of a reduction in vessel time in the terminal. Various places have been identified by the IWAI for the construction of cargo terminal and at some places cargo terminals are operational. The vessel operators are now experiencing better

infrastructure facility in the various terminal which gives them the reduction in the vessel time in the terminal.

- **Greater efficiency in vessel handling:** Proper infrastructure facility like better handling equipment in cargo terminals not only useful for a reduction in the vessel time in the terminal but also providing greater efficiency in vessel handling. The more advanced equipment taking less time to handle the cargo which saves time, money and fuel of the vessel operator which is directly increasing the efficiency of the vessel handling.
- **Increased vessel operating hours:** Navigational aids including River Information System, incident management systems are increasing vessel operating hours in the National Waterway 1. Due to the proper navigational facility, vessel operators are able to run their vessel in the night time also which is increasing the vessel operating hours
- **Improved safety:** Proper navigational infrastructure not only helpful in increasing the vessel operating hours but also improve the safety of man and machine both. Adequate infrastructure facility is very much inevitable to avoid any vessel collision of any undesirable incident.
- **Increased competition:** Government and IWAI is taking every possible step to Improve investment climate for the private sector in this project and that is the reason the competition between the vessel operators are increasing. This is a very positive sign for a government that they somehow managed to attract the private party to make an investment in this project which resulted in the increase in the competition.

4.5 Conclusion

In India, practically all the metro urban cities are battling with issues, for example, blockage, discharge from vehicles, air pollution, etc. At the point when we discuss transportation in a city, the principal thing that strikes a chord is Road transport. We generally attempt to take care of the clog issue by extending the street, development of streets, building flyovers, redirection, and so on. It is critical to comprehend the physical condition incorporates components of indigenous habitat, for example, atmosphere and geographical highlights. One such method of transport that was overlooked is Inland Water Transport System (IWT). IWT isn't just eco-friendly, condition cordial and cost productive method of transport yet additionally can possibly simplicity of weight on existing rail and street arrange.

A coordinated system of street, rail and inland Waterway can help being developed of productive vehicle framework in India. Trade Convenience, travel comfort, utilization of better innovation is key than achievement of street and water interconnected system. It should be consistent, coordinated, spotless and ok for all.

CHAPTER V

SUMMARY AND CONCLUSION

5.1 Summary

Jal Marg Vikas Project involves navigation capacity augmentation of the NW-1 so as to ensure the navigation through IWT mode throughout the year in entire NW-1. NW-1 is a natural waterway, extends from Haldia (Sagar) to Allahabad and spans 1620 km crossing the states of Bihar, Jharkhand, Uttar Pradesh & West Bengal. The project area includes entire reach NW-1 (Haldia to Allahabad) including the areas proposed for the development of project-related facilities & infrastructure, i.e. terminal sites, lock site, Ro-Ro jetty sites and sites for other planned development. NW-1 stretch traverses through various major cities and towns which are well connected by roads and railways. Developments proposed under Jal Marg Vikas project includes maintenance of LAD in navigation channel (3 m from Haldia to Barh, 2.5 m from Barh to Ghazipur and 2.2 m from Ghazipur to Varanasi), development of navigation infrastructure such as navigation aids, terminals (6 nos.), RO-RO crossings (5 nos.)/locks (1 no.), procurement of barges/dredgers and other necessary equipment, development and implementation of River information system, treatment of navigational hazards and carrying out bank protection and river training works at required locations.

Studies were carried out by survey consultant, existing cargo movement across the stretch of NW-1 through road & rail is 121426130 tonnes. Forecasted cargo studies are carried out by the survey consultant and cargo generation potential across NW-1 (Haldia to Varanasi) by the year 2045 is expected to be 4,80,11,367 tons. The project being of large spatial extent is planned to be developed in phases. At present planning has been carried out at 3 terminal sites, i.e. at Sahibganj, Varanasi, and Haldia. Sahibganj, Varanasi and Haldia terminal are designed to handle the cargo of 2.24 MTPA, 0.54 MTPA, and 3.18 MTPA respectively for phase I depending on available infrastructure. Navigation channel of 45 m width is planned to be maintained from Haldia to Varanasi stretch through dredging between Haldia and Varanasi.

No dredging beyond Varanasi is planned to be undertaken at present. Dredging quantity of app. 14.85 million cum is estimated to be undertaken between Haldia and Varanasi to ensure

year-round navigation. This also includes the dredging quantity to be undertaken at the terminal sites. Major dredging requirement is anticipated at Haldia terminal only

5.2 Suggestions

Some of the observations made from Trader's perspective are as follows-

Absence of awareness about the multi-modal terminal among the traders is posing a barrier to the business of Terminal. Till now the terminal is in its development stage however it's a multimodal terminal yet as of now it is just giving sea transportation and dealers are for the most part keen on door-to-door facility. Demand and Supply gap between available vessels for movement is also a stumbling block. As the venture is in its development stage, so government should take initiative like subsidies in tariff given to the traders so that they will get attracted towards the terminal. Nonappearance of appropriate navigational offices in channel water around evening time. Pontoon bridges in the middle of the navigational water goes about as a boundary.

Some suggestions for the NW-1 Project based on this study are-

- Strengthening public-private partnership has the key role to play in developing the inland waterways sector. Private players can undertake terminal development, cargo and passenger handling, and building low-draft vessels and related repair facilities.
- Measures ought to be taken to create fundamental framework, address mechanical Bottlenecks and upkeep of streams to guarantee all year navigation
- Measures ought to be taken to guarantee accessibility of consistent, multimodal last mile availability to and from the hinterland to lessen trans-shipment cost and make inland water transport financially progressively practical
- Cargo transport through inland waterways should be incentivized. Following measures can be taken:
 - The Government can mandate/incentivize industries in the proximity of national Waterways to use this mode for a portion of their shipments.

- The government can promote industrial corridors along riverbanks and foster Waterways-based industrialization.
- Higher road taxes can be levied on transportation of coal and inflammable material over longer distances
- The government should develop passenger terminal, offer financial support to ferry operators to improve safety, and facilitate insurance coverage to boost passenger transport
- Keeping as a primary concern the worries, it is essential to survey the natural and social effect of the improvement of inland Waterway and related framework to nullify expected harm.
- Proper and condition well disposed dredging of waterways.

5.3 Conclusion

An economy has minimal possibility of prospering in the event that it comes up short on certain essential conditions like effective vehicle. In any case, mounting volumes of traffic negatively affect the earth. Traffic clog and contamination lead us to search out methods of transport that are less naturally hurtful. This is the reason Inland water Transport has huge potential, regarding both limit and coordinations. It might be conceivable to incorporate inland Waterway with seaside ports to oblige waterfront and universal traffic. Till now, high transshipment costs have obstructed the development of between modular vehicle. By consolidating inland terminals with new computerized Ro-Ro framework, the expense of transshipment can be limited by and large. Ro-Ro fitted vessels offer an astounding option in contrast to street haulage on specific passageways. Such vessels would have the option to arrive at certain inland areas by means of inland Waterway This could take a portion of the traffic load off the street organize and realize a superior parity to the different methods of transport. As the inland Waterway interface enroute settlements/towns and serves in reverse district, they give boosts to grow little scope and house enterprises in rustic zones. The inland Waterway assume a significant job in the financial inspire of provincial territories improvement by giving genuinely necessary work, network, better water system, growth of fish culture and advancement of the travel industry in the State.

BIBLIOGRAPHY

1. Prof. B.S.Thandaveswara (2013), National Waterways of India, National waterways, 29 July 2013.
2. Arnab.Bandyopadhyay (2017),India - Capacity Augmentation of the National Waterway- 1 (JAL MARG VIKAS) Project : P148775 - Implementation Status Results Report : Sequence 01 (English) 26 Dec. 2017, Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/347591514285322532/India-Capacity-Augmentation-of-the-National-Waterway-1-JAL-MARG-VIKAS-Project-P148775-Implementation-Status-Results-Report-Sequence-01>.
3. Meenakshi Kapoor, Krithika A. Dinesh (15 May 2020), Cheaper Coal transport through water and Sky could come at cost of environment, india.mongabay.com.
4. Ht Correspondant, (12 Sept. 2009), National waterway to be Operational from march 2010, www.hindustantimes.com/patna/national-waterway-to-be-operational-from-march-2010/story-QHL9OxJenqp8ecizOOkOvM.html.
5. Jal marg Vikas Project, Inland Waterways Authority of India, Publications, Draft EIA Report Varanasi Terminal, <http://jmvp.nic.in/publication>.
6. Shripad Dharmadhikary, Jinda Sandbhor (30 March 2017), National Inland Waterways in India: A Strategic Report, New Delhi, Manthan Adhyayan Kendra and SRUTI.
7. Ministry of Shipping (October 2006), The Working Group Report On Shipping and Inland Water Transport for 11th 5 year Plan, Ministry of Shipping.
8. Sharma, D.K. (2010), India's National Waterways-A long Way to Go, Transport Research Wing, Ministry of Shipping.
9. Narayan Rangraj and G. raghuram (2007), Viability of Inland water Transport in india, INRM No. 13, New-Delhi, Asian Development Bank.
10. Shri. Pon radhakrishnan (December 2018), RITES Report on Operational national waterways in Country, New-Delhi, Ministry of Shipping- Govt. of India.