# TO STUDY THE ECONOMIC IMPACT OF JAL MARG VIKAS PROJECT (NATIONAL WATERWAY-1) IN VARANASI, UTTAR PRADESH: A CASE STUDY

Dissertation submitted to the Panjab University, Chandigarh for the award of degree of Master of Arts in Public Administration and Public Policy, in partial fulfillment of the requirement for the Advance Professional Programme in

Public Administration (2024-25).


Submitted by

**Brig Sachin Dubey, SM**

**Roll No 5006**

Under the Guidance and supervision of

**Faculty Guide Professor VN Alok**


**50th ADVANCED PROFESSIONAL PROGRAMME IN PUBLIC ADMINISTRATION (2024-25)**

**INDIAN INSTITUTE OF PUBLIC ADMINISTRATION**

**NEW DELHI**

## SELF DECLARATION CERTIFICATE

I, the undersigned hereby declare that the dissertation titled "To Study the Economic Impact of Jal Marg Vikas Project, (National Waterway-1), in Varanasi, Uttar Pradesh: A Case Study" submitted by me for award of the Degree of Master of Arts in Public Administration and Public Policy is original and this work or part thereof has not been submitted for the award of any degree or diploma either in this or any other University. All the sources I have accessed or quoted have been indicated or acknowledged by means of references.

Date: March 2025

Place: New Delhi

(Sachin Dubey)
Brigadier
Indian Institute of Public Administration
New Delhi – 110002

## CERTIFICATE

I have the pleasure to certify that Brigadier Sachin Dubey has pursued his research work and prepared the present dissertation titles "To Study the Economic Impact of Jal Marg Vikas Project, (National Waterway-1), in Varanasi, Uttar Pradesh: A Case Study" under my guidance and supervision. The same is the result of research done by him and to the best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. This is being submitted to the Panjab University, Chandigarh, for the purpose of Master of Arts in Public Administration and Public Policy in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA) on Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Brigadier Sachin Dubey is worthy of consideration for the award of Master of Arts degree of the Panjab University, Chandigarh.

Date: March 2025
Place: New Delhi

(V.N. Alok)
Professor
Indian Institute of Public Administration
New Delhi – 110002

## ACKNOWLEDGMENTS

I acknowledge and place on record my deep gratitude to Shri Surendra Nath Tripathi, IAS (Retd), Director General, Indian Institute of Public Administration (IIPA), all the faculty members and staff of the for the guidance and assistance provided to me in carrying out my research work. I would also like to thank the IIPA for giving me the opportunity to undertake my research thesis in this extremely relevant and contemporary subject and for all the infrastructural support and facilities provided. My sincere appreciation also goes out to the IIPA Library Staff and Office Staff who have tirelessly and with great dedication assisted me in sourcing quality reference material. I wish to express my special gratitude to Professor V.N. Alok for the unconditional support extended to me as my faculty Guide for the research study. He has been the epitome of a true mentor, guide, friend and philosopher in this journey. He was always accessible and willing to render professional advice for the conduct of this study, without which it would not have been possible and has been a source of immense inspiration for me. I would also like to thank Professor Neetu Jain and Dr Saket Bihari, Program Directors for providing me adequate time to carry out my research and creating a very congenial environment for gaining knowledge as part of the curriculum. I also place on record my sincere thank you to my family and colleagues for supporting my efforts during this period.

Date: March 2025 (Sachin Dubey)

Place: New Delhi Brigadier

Roll No – 5006

## TABLE OF CONTENTS


| Serial | Topic | Page No |
|---|---|---|
| (i) | Self Declaration Certificate | ii |
| (ii) | Certificate | iii |
| (iii) | Acknowledgement | iv |
| (iv) | Table of Contents | v-vi |
| (v) | List of Abbreviations | vii-viii |
| (vi) | List of Figures | ix |
| (vii) | List of Tables | x |
| (viii) | Abstract | xi-xiii |
| 1. | Chapter I: Introduction and Historical Perspective of Inland Waterways | 1-24 |
| 2. | Chapter II: Research Methodology | 25-29 |
| 3. | Chapter III: Review of Literature | 30-40 |
| 4. | Chapter IV: Current State of Inland Waterways | 41-64 |
| 5. | Chapter V: Study Area Findings | 65-98 |
| 6. | Chapter VI: Analysis and Recommendations | 99-120 |
| 7. | Bibliography | 121-124 |
| 8. | Appendix A- Questionnaire | 125-132 |
| 9. | Appendix B- Details of MTT | 133 |

| | | |
|---|---|---|
| 10. | Appendix C- Cargo movement from M.M.T. Varanasi after its inauguration | 134-135 |
| 11. | Appendix D- Design Details of Jetty at MMT, Varanasi | 136 |
| 12. | Appendix E- Status of Community Jetties and Onshore Facilities in Uttar Pradesh | 137-138 |

## LIST OF ABBREVIATIONS

| Abbreviation | Full form |
|---|---|
| ADB | Asian Development Bank |
| AIS | Automatic Identification Systems |
| BHU | Bharat Hindu University |
| CNG | Compressed Natural Gas |
| CSR | Corporate Social Responsibility |
| DWT | Dead Weight Tonnage |
| DFC | Dedicated Freight Corridor |
| EDFC | Eastern Dedicated Freight Corridor |
| FMGC | Fast Moving Consumer Goods |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GST | Goods and Services Tax |
| IBRD | International Bank for Reconstruction and Development |
| ICSL | Inland & Coastal Shipping Ltd |
| IIR | Internal Rate of Return |
| IMT | Intermodal Terminal |
| INR | Indian Rupee |
| IWT | Inland Water Transport |
| IWAI | Inland Waterways Authority of India |
| JICA | Japan International Cooperation Agency |
| JMVP | Jal Marg Vikas Project |

| Abbreviation | Full form |
|---|---|
| LAD | Least Available Depth |
| LNG | Liquefied Natural Gas |
| MHC | Mobile Harbour Cranes |
| MW | Megawatt |
| MMT | Multi Modal Terminal |
| MMTPA | Million Metric Tons Per Annum |
| MoU | Memorandum of Understanding |
| NGRBA | National Ganga River Basin Authority |
| NH | National Highway |
| NHAI | National Highways Authority of India |
| NPV | Net Present Value |
| NW | National Waterway |
| PIB | Press Information Bureau |
| PPP | Public Private Partnership |
| RIS | River Information System |
| Ro-Ro | Roll On-Roll Off |
| TEU | Twenty foot Equivalent Unit |
| USD | United States Dollar |
| VNN | Varanasi Nagar Nigam |
| WR, RD & GR | Water Resources, River Development & Ganga Rejuvenation |

## LIST OF FIGURES AND TABLES


| Figure No | Topic | Page No |
|---|---|---|
| 1.1 | Map showing the course of the Tigris and Euphrates Rivers | 6 |
| 1.2 | Map showing the course of the Nile River | 9 |
| 1.3 | Map showing the course of the Indus River | 13 |
| 4.1 | Map showing National Waterway 1 | 44 |
| 4.2 | Map showing National Waterway 2 | 45 |
| 4.3 | Map showing National Waterway 3 | 46 |
| 4.4 | Map showing National Waterway 4 | 47 |
| 4.5 | Map showing National Waterway 5 | 48 |
| 4.6 | Location of Site of Multi Modal Terminal | 56 |
| 4.7 | Road connectivity for Varanasi Multimodal IWT Terminal | 60 |
| 4.8 | MMT Site and Railway Network | 61 |
| 5.1 | Snapshot of Respondents of Surveys | 68 |
| 5.2 | Views on Awareness and Perception of National Waterways | 69 |
| 5.3 | Respondents Views on Economic Impact of JMVP and MMT | 71 |
| 5.4 | Respondents Views on Employment and Skill Development | 73 |
| 5.5 | Respondents Views on Use of Waterways for Military Logistics | 76 |
| 5.6 | Respondents Views on Tourism and Environmental Impact | 78 |

| **Table No** | **Topic** | **Page No** |
|---|---|---|
| 4.1 | Traffic Potential at Varanasi MMT | 57 |
| 4.2 | Proposed Berth Capacity for Development at MMT, Varanasi | 58 |
| 4.3 | Types of Vessels to Operate at the MMT, Varanasi | 59 |
| 4.4 | Map showing National Waterway 1 | 44 |
| 4.2 | Map showing National Waterway 2 | 45 |
| 4.3 | Map showing National Waterway 3 | 46 |
| 4.4 | Map showing National Waterway 4 | 47 |
| 4.5 | Map showing National Waterway 5 | 48 |
| 4.6 | Location of Site of Multi Modal Terminal | 56 |
| 4.7 | Financial Analysis of MMT, Varanasi | 63 |

## ABSTRACT

The Jal Marg Vikas Project (JMVP) is a flagship initiative by the Government of India which aims to develop the National Waterway-1 (NW-1) to enhance inland water transport (IWT) along the River Ganga. This dissertation examines the historical economic, infrastructure and land policy aspects of inland waterways in India, with particular focus on the impact of JMVP on Varanasi which is a key multimodal transport hub on NW-1. Historically, waterways have played an important role in civilisations, serving as crucial pathways for trade, agriculture and human settlements. Ancient civilizations to include Mesopotamia, the Indus Valley and Egyptian flourished along major rivers due to their accessibility to fresh water, fertile land and trade routes. In India, rivers like the Ganga, Yamuna and Brahmaputra acted as principal trade routes connecting various regions. During the Mauryan and Gupta periods, inland waterways were extensively used for commerce and connectivity. This trend also continued in the Mughal era. The British colonial period also saw significant investments in water transport, with cities like Kolkata Varanasi, Pragyag emerging as important commercial hubs. However, in the early 20$^{th}$ century, with the advent of roads and railways inland waterways declined and were neglected in favour of modern transportation networks.

The National Waterways Act of 2016 and other Government schemes and interventions have enabled the resurgence of inland waterways. The JMVP project aims to reduce logistics costs, increase trade efficiency and promote sustainable transportation on NW-1. IWT is significantly cheaper than road and rail transport; studies indicate that transporting goods via waterways costs Rs 0.35 per ton/km, compared to Rs 1.36 by road and Rs 0.85 by rail. The enhanced navigability of NW-1 has improved connectivity

between Varanasi and Kolkata. The construction of major Multimodal Terminals (MMTs) at Varanasi, Sahibganj and Haldia are crucial for supporting cargo movement and industrial connectivity along the waterway. Additionally, strengthening linkages between waterways, railways and road networks is expected to boost multimodal transport and logistics efficiency. The project is supported by funding from the World Bank, the Government of India and private sector investments under Public-Private Partnership (PPP) models.

JMVP however faces several challenges. Seasonal variations in water levels significantly impact navigation, especially during monsoons and dry seasons necessitating constant dredging and depth maintenance. Lack of scheduled operations and less number of vessels further compounds the problem leading to a confidence deficit amongst the business community to use the waterways as an alternate to roads and railways. Regulatory hurdles also present a challenge, as multiple agencies, including the Inland Waterways Authority of India (IWAI), state governments and environmental bodies, oversee different aspects of the project, leading to administrative complexities and time delays.

The economic impact of the JMVP on Varanasi par se has been moderate. Various hurdles such as insufficient depth in the waterways, fewer vessels, lack of cargo and non availability of a railway line have led to the sub optimal utilization of the MMT in Varanasi. The development of community jetties in Varanasi, as part of the JMVP have majorly improved connectivity within Varanasi and also boosted river based tourism and pilgrimage activities, enhancing the overall attractiveness of the city. Use of CNG based vessels has also had a positive impact on environmental conservation.

To realise the full potential of JMVP, several strategic policy recommendations have been proposed. Encouraging greater private sector participation through PPP models can enhance efficiency in port management and cargo handling operations. Strengthening intermodal connectivity between road, rail and waterways is necessary to ensure seamless transport networks. The use of advanced technologies for navigation and automation in cargo handling will further improve the operational efficiency. Involving the Mallah community as a key stakeholder will instill confidence and enhance river tourism in the region. In addition environmentally friendly dredging techniques and effective waste management strategies need be integrated to maintain ecological balance and minimise disruption to the aquatic ecosystem of the Ganga.

In conclusion the JMVP is an important linchpin in India's inland water transport revival**.** There are positive economic outcomes of the project on Varanasi; however the current operational deficiencies, industry reluctance, navigability issues and socio economic conflicts need to be addressed through Government policy interventions to ensure its success. This will enable Varanasi to emerge as a key multimodal logistics hub, driving long term prosperity for businesses, industries and local communities alike while preserving the cultural and ecological heritage of the Ganga.

# CHAPTER 1

# INTRODUCTION

1.1 Waterways and their Significance. Waterways consist of rivers, lakes canals and coastal routes historically serving as vital lifelines for human societies. They have shaped not only the physical landscapes but also the cultural, political and economic trajectory of civilizations over centuries. These aquatic networks are broadly categorised into natural rivers, lakes, canals and reservoirs. While natural waterways result from geographical and climatic phenomena, artificial ones reflect human inventiveness in modifying and harnessing nature for specific purposes.

Waterways are all encompassing and their significance extends beyond their practical usage. Rivers like the Nile, Indus, Euphrates and Amazon have been regarded as sacred and are often associated with deities and cosmic principles in ancient religions. Beyond their symbolic value, waterways have connected different communities, facilitating the exchange of ideas, goods and technologies. Thus waterways are not merely physical features but also essential conduits of human progress, fostering interdependence and shared growth across regions.

Historically, the role of waterways in societal development is evident from examining the recurring patterns of early human settlement. Nearly all major ancient civilizations, from Mesopotamia to the Indus Valley, were established along rivers. The rich alluvial soil along the banks of these rivers proved ideal for agriculture and mass grain production, an essential prerequisite for sustaining large populations. However, the benefits of waterways extended beyond food production. Their navigability allowed them to function

as arteries of commerce and trade and lead to the establishment of the early trade markets and economies.

1.2 Importance of Waterways in Early Human Societies. In early human societies, the availability of water significantly influenced settlement patterns. Rivers, serving as reliable sources of fresh water, were essential for drinking, sanitation and agriculture. The fertile floodplains of rivers such as the Nile, Tigris and Ganges enabled the abundant cultivation of crops, allowing societies to transition from nomadic lifestyles to settled communities. The rise of agricultural surpluses supported larger populations and led to the emergence of urban centers and complex social hierarchies. Beyond providing sustenance, waterways were vital for mobility. Rivers acted as natural highways during an era when overland transport was often arduous and slow. Boats and rafts made from locally available materials allowed early humans to traverse long distances efficiently. This ease of transportation fostered interregional trade, with rivers serving as the initial trade routes. For instance, Mesopotamian merchants navigated the Tigris and Euphrates to transport textiles, grain and ceramics to neighboring regions, facilitating cultural exchanges that laid the foundation for more extensive trade networks. Additionally, waterways played a crucial role in shaping the cultural and spiritual aspects of early societies. Water is also regarded as a sacred element, as reflected in various religious practices and mythologies. In Hinduism, the Ganges River is viewed as a goddess, believed to purify the soul and cleanse sins. Similarly, the inundations of the Nile were regarded as blessings from the gods in ancient Egypt. This reverence highlights the deep connection between waterways and the human experience, transcending their practical utility.

1.3 Waterways as Catalysts for Economic and Technological Change. Ancient civilizations' reliance on waterways also inspired numerous technological advancements. Shipbuilding became a critical innovation, enabling humans to navigate rivers, lakes and seas more effectively. Early vessels made from reeds, logs, or animal skins evolved into larger, more sophisticated ships capable of carrying significant cargo. The development of the sail was especially groundbreaking, allowing seafarers to harness wind energy and expand their reach beyond inland waterways to open seas.

Economic advancements were equally notable. Rivers facilitated the transport of goods and led to the development of commercial hubs. Cities like Babylon on the Euphrates and Memphis on the Nile transformed into bustling trade centres, connecting agricultural hinterlands with urban markets. Goods such as grain, textiles, spices and metals were exchanged, forming the backbone of early economies. Navigable waterways often determined a region's economic prosperity by providing an efficient and cost effective means of transport compared to overland routes.

Additionally, waterways were integral to the organization of labour and the distribution of wealth. The construction of irrigation systems and canals required large scale coordination, often directed by governments. This process showcased the administrative capabilities of ancient societies and laid the foundation for socio economic hierarchies. For instance in Mesopotamia, temple authorities managed irrigation projects, reinforcing the link between political power and religion through control over the water resources.

While natural waterways were abundant and beneficial, their limitations often led to the creation of artificial channels to meet specific needs. Canals are amongst the earliest

examples of human innovation in water management. In ancient Mesopotamia, canals diverted water from the Tigris and Euphrates Rivers to arid regions, transforming them into fertile farmland. These canals enhanced agricultural productivity and extended the reach of the riverine trade networks.

One of the most remarkable achievements in water engineering was the construction of the Grand Canal in China. Spanning over 2,000 km, it connected the Yellow and Yangtze Rivers, facilitating the movement of goods and people across vast distances. This canal was crucial in integrating the Chinese empire, enabling flow of grain and other resources from the agriculturally rich South to the politically dominant North.

Artificial waterways also supported urban development by ensuring a steady water supply. Roman aqueducts exemplify this innovation, transporting fresh water from distant sources to urban centers. These structures provided drinking water and supported public baths, fountains and sanitation systems, contributing to the health and hygiene of Roman society. The success of such projects showcases the ingenuity of ancient civilizations in overcoming environmental challenges.

1.4 Cultural and Political Dimensions of Waterways. Control over waterways has historically been a source of power and conflict. In ancient times, the strategic importance of rivers often led to rivalries between neighbouring states. Mesopotamian states like Ur and Lagash frequently clashed over access to water from the Tigris and Euphrates. Similarly, control of the River Nile was central to the unification of Upper and Lower Egypt under a single Pharaoh.

Waterways also served as cultural symbols, representing unity and identity. The Nile, for instance, was not just a physical connector but also a cultural one, uniting Egypt's two distinct regions. In India, rivers like the Ganges and Yamuna hold immense spiritual significance, forming a core part of national and cultural identity. The sacredness of these rivers is celebrated in religious rituals, festivals and literature, reflecting their deep rooted influence on the Indian society.

Politically, waterways often demarcated boundaries between states and empires. The Rhine River, for example, has long served as a natural border between different political entities in Europe. During the colonial era, controlling key waterways such as the Suez Canal and the Strait of Malacca became critical to European powers seeking dominance over global trade. These waterways were economic lifelines and geopolitical chess pieces, reflecting their enduring strategic importance.

**Ancient Civilizations and Waterways**

1.5 Mesopotamia: Role of the Tigris and Euphrates Rivers. Originating in the highlands of eastern Turkey, the Tigris and Euphrates Rivers flow southward through Syria and Iraq before merging into the Shatt al Arab and emptying into the Persian Gulf. These rivers define the Mesopotamian plain, a fertile region described as one of the most geographically advantageous areas for early human settlement. The Tigris is known for its faster current and more unpredictable flooding than the Euphrates, which flows more gently and predictably. This duality shaped the nature of settlements and irrigation practices along each river.

**Fig 1.1: Map showing the course of the Tigris and Euphrates Rivers**


**Source: Britannica**

The river's annual flooding deposited nutrient rich silt onto the surrounding plains, replenishing the soil and making it suitable for intensive agriculture. This phenomenon, known as alluvial deposition, created a landscape uniquely conducive to sustaining large populations. However, unlike the predictable flooding of the Nile, the Tigris and Euphrates presented significant challenges. Floods could occur at unexpected times and with varying intensity, necessitating advanced planning and water management techniques. Archaeological evidence shows that early Neolithic communities settled along these rivers as early as 10,000 BC. Over millennia, these settlements grew into some of the first cities in human history, including Uruk, often regarded as the world's first actual city.

Agriculture in Mesopotamia heavily depended on the ability to control and distribute water from the Tigris and Euphrates. Early Mesopotamians developed a complex irrigation system to prevail over the arid conditions and unpredictable flooding, marking one of the most significant achievements of ancient engineering. These systems included networks of canals, levees and reservoirs designed to channel floodwaters to fields and store water for the dry seasons.

One of the most prominent examples of Mesopotamian ingenuity is the ancient canal system of the Sumerians.The Great Canal of Uruk extended for miles and supported the agricultural economy of one of the earliest urban centres. Records on clay tablets detail the organisation required to maintain these systems, including allocating labour and resources. Temple authorities and later governments played key roles in overseeing irrigation, reflecting the intertwining of religious and administrative functions in early Mesopotamian society.

The effects of these irrigation systems were profound. By transforming arid landscapes into fertile fields, the Mesopotamians could produce surplus crops, which supported population growth and the development of specialised professions. However, the intensive use of irrigation also had long term environmental impacts. Over time, the accumulation of salts in the soil, a process known as salinisation, reduced agricultural productivity and may have contributed to the decline of certain states.

The Tigris and Euphrates Rivers were pivotal in the rise of urban centres in Mesopotamia. Cities like Uruk, Urand Babylon grew into bustling cultural, administration and commerce hubs, mainly due to their strategic locations along these

waterways. The rivers facilitated the transport of goods and people, enabling cities to sustain large populations and complex economies.

Trade was a cornerstone of Mesopotamian civilization and the rivers served as the primary arteries of this trade. Goods such as grains, textiles, pottery and metals were transported along the rivers, connecting Mesopotamian cities with distant regions. These interactions enriched Mesopotamian culture and contributed to the spread of technologies like metallurgy and writing.

The Tigris and Euphrates were also deeply entrenched in Mesopotamian religion and mythology. These rivers were often embodied as deities and seen as life giving and destructive forces. For instance, the Sumerian God Enki, connected with water, wisdom and creation, was believed to govern the earth's waters.

The rivers are also prominently featured in Mesopotamian literature. The Epic of Gilgamesh, one of the oldest known literary works, refers to the rivers as symbols of life, fertility and renewal. Rituals and festivals celebrating the rivers' inundations highlight their centrality to Mesopotamian culture. Temples dedicated to water deities often included pools or channels to represent the life giving properties of these rivers.

1.6 Egypt: The Nile as a Lifeline. The Nile River is the longest river in the world stretching over 6,600 km and the defining feature of Egypt's geography. Flowing from its sources in the highlands of East Africa through the arid deserts of Sudan and Egypt, the Nile culminates in the Mediterranean Sea. Its two major tributaries, the White Nile and the Blue Nile, converge at Khartoum in Sudan before flowing northward. The

Nile Valley, a narrow strip of fertile land bordered by vast deserts, was a natural corridor for developing the ancient Egyptian civilization.

**Fig 1.2: Map showing the course of the Nile River**


**Source: Britannica**

The Nile's annual deluge, caused by seasonal rains in its upper reaches, was the foundation of Egyptian agriculture. Between June and September, the river overflowed its banks and deposited a layer of rich silt onto the surrounding floodplains. This natural phenomenon was known as the "Gift of the Nile," and it replenished the soil and made it

ideal for growing crops such as wheat, barley and flax. The Egyptians developed a calendar and agricultural cycle based on the river's predictable flooding, dividing the year into three seasons: Akhet (flooding), Peret (planting) and Shemu (harvesting).

The Nile's floodwaters were the lifeblood of Egyptian agriculture and the Egyptians devised ingenious methods to harness its resources. Early farming communities relied on the natural flood cycle, planting crops as the waters receded and harvesting before the subsequent inundation. Over time, they developed more sophisticated irrigation techniques to extend cultivation beyond the floodplains.

Canals and basins were integral to the Egyptian irrigation system. Farmers constructed networks of channels to divert floodwaters to fields, while basins stored water for use during the dry season. This system allowed crop cultivation in areas not directly reached by the Nile's floodwaters.

The construction and maintenance of irrigation infrastructure required coordinated efforts, often organized by local communities or overseen by the state. This collective labour reinforced social cohesion and highlighted the interdependence of rural and urban populations. Surplus agricultural production supported Egypt's growing population and enabled the emergence of a complex society with specialized professions, from scribes to artisans. Agricultural prosperity also underpinned Egypt's trade networks. The surplus grain produced along the Nile was exported to neighbouring regions, including the Levant and Nubia, establishing Egypt as a dominant economic power in the ancient world.

The Nile's role as a transportation artery was critical to the growth of Egyptian cities and the integration of the kingdom. Boats made from papyrus reeds and later wooden vessels carried goods, people and ideas along the river, connecting the farthest reaches of the kingdom.

Urban centres such as Memphis and Thebes thrived due to their strategic locations along the Nile. Memphis, situated near the Nile Delta, served as a political and economic hub, benefiting from its proximity to fertile farmland and trade routes. Thebes subsequently also emerged as a religious centre, further upriver, home to grand temples such as Karnak and Luxor.

Trade along the Nile was not confined to internal exchanges. The river connected Egypt to the larger Mediterranean world, facilitating the import of luxury goods such as cedar wood from Lebanon, silver from Anatolia and lapis lazuli from Afghanistan. The Nile also provided access to Nubia in the South, a region rich in gold, ivory and other valuable resources. Egyptian expeditions to Nubia, recorded in inscriptions and tomb reliefs, highlight the river’s role in sustaining Egypt’s wealth and power. The Nile was not merely a physical resource but deeply woven into Egyptian society's cultural and spiritual fabric. The river was personified as Hapi, the Nile's God, associated with fertility, abundance and renewal. Annual festivals celebrated the inundation, which was seen as a blessing from the gods. Hymns and prayers addressed to the Nile express gratitude for its life giving waters and reflect its centrality to Egyptian identity.

The Nile also played a symbolic role in Egyptian cosmology. It was believed to flow from a primordial source, representing the eternal cycle of life, death and rebirth. This

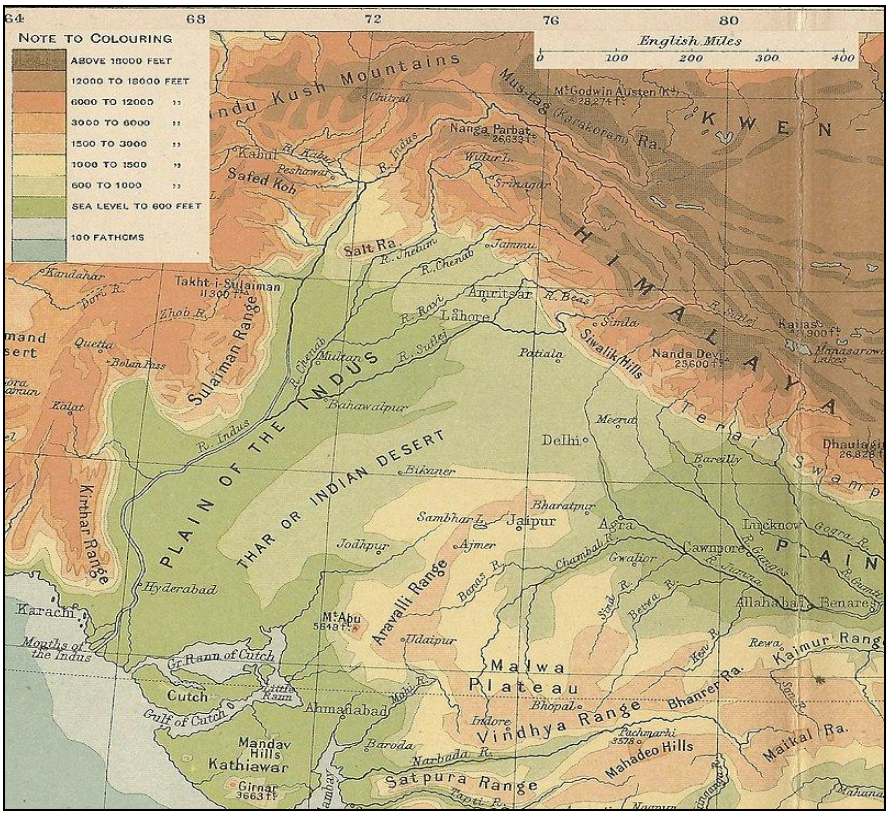
symbolism is evident in the construction of tombs and temples along the riverbanks. The West bank, associated with the setting sun and the afterlife, became the preferred location for burials. In contrast, the East bank, where the sun rose, was associated with life and renewal. The Nile influenced Egyptian art and literature as well. Depictions of river scenes, including fishing, boating and farming, were common in tomb paintings, emphasizing the river's importance in daily life.

The Nile's influence on Egyptian technology extended beyond irrigation, the river facilitated the transport of massive stone blocks to construct pyramids, temples and other monumental structures. Wooden sledges and barges carried these blocks from quarries to building sites, highlighting the Egyptians' logistical ingenuity.

The Nile's legacy extends into modern times. Egypt's reliance on the river continues, with the Aswan High Dam standing as a testament to the enduring relationship between the Nile and its people.

1.7 Indus Valley Civilization. The Indus River, one of the longest rivers in the world, flows for approximately 3,180 km from its source in the Tibetan Plateau, through the northern regions of the Indian subcontinent and into the Arabian Sea. Its tributaries such as the Ravi, Beas, Sutlej, Chenab and Jhelum form a vast network that irrigates the fertile plains of present day Pakistan and northwest India. The Harappan Civilization flourished on its banks between 2600 and 1900 BC.

**Fig 1.3: Map showing the course of the Indus River**




**Source: Britannica**

The Indus River created a favourable environment for early agricultural societies. Its annual flooding deposited rich alluvial soil, replenishing nutrients essential for farming. Unlike the unpredictable floods of the Tigris and Euphrates, the Indus floods were relatively regular and gentle, allowing the Harappans to cultivate crops such as wheat, barley and pulses with remarkable consistency. Additionally, the river provided a reliable source of fresh water for drinking and sanitation, ensuring the sustainability of dense urban settlements.

The geography of the Indus Valley also offered strategic advantages. The river system facilitated internal connectivity and linked the civilization to distant regions, including

Mesopotamia and Central Asia. This connectivity supported trade and enabled the exchange of ideas, technologies and cultural practices.

Agriculture was the cornerstone of the Indus Valley Civilization and the Indus River was central to its success. The fertile floodplains supported intensive cultivation, allowing the production of surplus food that sustained large urban centres. Archaeological evidence suggests that the Harappans employed advanced farming techniques, including crop rotation and the use of ploughs, to maximise yields.

Water management was a defining feature of Harappan society. The civilization developed sophisticated systems to harness the Indus and its tributaries for irrigation. Canals and reservoirs were constructed to channel floodwaters to fields and store water during dry periods. These systems ensured food security and mitigated the risks associated with fluctuating water levels.

One of the most remarkable aspects of Harappan water management was its integration into urban planning. Mohen Jo Daro and Harappa featured extensive drainage networks, wells and public baths, reflecting a deep understanding of hydrology and engineering. These systems highlight the Harappans' ability to organize large scale labour and maintain infrastructure over time. The presence of granaries in many urban centres suggests centralised storage and distribution of agricultural surplus, underscoring the importance of water and food security to the civilization's stability.

The Indus River was pivotal in the rise of urban centres in the Harappan Civilization. Cities like Mohen Jo Daro, Harappa and Dholavira were strategically located along the river and its tributaries, benefiting from access to water and trade routes. These cities

were among the most advanced of their time, featuring planned layouts, standardised brick sizes and complex drainage systems.

Trade was a cornerstone of the Harappan economy and the Indus River served as a vital conduit for commerce. Boats navigated the river, transporting cotton textiles, beads and ceramics to neighbouring regions. Harappan seals and artifacts have been discovered in Mesopotamian cities, indicating a robust exchange network. These trade links facilitated the movement of goods and the spread of technologies, such as metallurgy and writing systems.

The river also connected the Harappans to the Arabian Sea, enabling maritime trade. Ports such as Lothal, located near the Gulf of Khambhat, were essential hubs for seafaring merchants. Lothal's dockyard, one of the oldest known in the world, demonstrated the Harappans advanced knowledge of maritime engineering and their ability to engage in long distance trade.

Water held profound cultural and religious significance for the Harappans, as evidenced by the prominent role of bathing and sanitation in their cities. The Great Bath of Mohen Jo Daro, a large, brick lined tank surrounded by colonnades, is believed to have served a ritualistic or communal function. Its careful construction and central location suggest it was a focal point of religious or social activities.

The Indus River likely played a central role in Harappan spirituality, symbolising purity and renewal. While the Harappans' religious beliefs remain largely enigmatic due to the undeciphered script, the prevalence of water related structures in their cities indicates its

importance in their worldview. The emphasis on cleanliness and water storage reflects a reverence for water as a life-sustaining force.

The river also influenced Harappan's art and iconography. Seals and figurines often depict animals, trees and other elements associated with water, reflecting its role in their cultural identity. The recurring motifs of rivers and water bodies in Harappan artifacts highlight their intimate connection with their aquatic environment.

The need to manage the Indus River and its tributaries drove technological advancements in the Harappan Civilization. Their expertise in engineering is evident from the construction of reservoirs, wells and drainage systems. Integrating these systems into urban planning demonstrates a level of sophistication unmatched by most contemporary civilizations.

The legacy of the Indus Valley Civilization endures in South Asia's cultural and historical narratives. The river remains a vital resource for millions, supporting agriculture, industry and daily life. Modern projects such as the Indus Basin Irrigation System continue to harness the river's potential, building on the achievements of their ancient predecessors.

1.8 Historical Overview of Inland Waterways in India. Traditionally, inland waterways in India have played a vital role for centuries, being an essential mode for the shipment of trade and transportation, especially before the advent of railways and modern road infrastructure. During the Indus Valley Civilization, rivers like the Indus were pivotal for transportation and trade, with boats being the primary means of moving goods and individuals. Ancient texts from the Vedic period also allude to the use of rivers such

as the Ganges and Yamuna for navigation and trade, thus highlighting their importance in early economic activities.

1.9 Period of Imminence (up to 12th Century A.D.). In the absence of roadways and railways, waterways were the only available highways for the movement of goods and people in ancient India. The Ganga, Yamuna in the North and Narmada, Tapi and Godavari in the South were comprehensively used for commercial navigation. Water transportation reigned supreme as no other system could offer better services. Boats and rivers became part and parcel of the social and cultural life of the people. We read in *Ramayana* that Lord Ram crossed the river Ganga on a ferry boat near Prayagraj and paid a fee to the *Kevat*. In his battle against King Porus, Alexander's Army crossed the Jhelum by boats. During the golden age of the Gupta Empire, the rivers attained special significance in the economy as almost the whole Ganga valley came under the Gupta Empire; and distance travel became possible. In addition, the extraordinary development of trade and commerce gave rise to several commercial and religious towns like Indraprastha, Mathura, Prayag, Kashi, etc.

1.10 Period of Comparative Growth (12th to 15th Centuries A.D.). Waterways remained important even with the downfall of Hindu dynasties and the rise of Mughal rule in the 10th century. Several feeder roads were connected to the waterways. All along the Ganga, cargo and passenger handling was provided, spurning trade and commerce in the region. In the South, the Coromandel and Malabar coasts saw an increase in trade between India and other West and East Asian countries.

1.11 The Golden Period (1550 to 1850 A.D.). This period witnessed the ascendency of the waterways as the foremost transport arteries of the country. Long distance journeys were quite popular and were being safely undertaken. During this period, the population along the Gangetic plains also grew, fuelling the demand for goods and services. The advent of mechanically driven vessels in the 19$^{th}$ century gave a fillip to the industry and did not require initial financial outlays such as roads and railways. The discovery of steam power was apt to be used on waterways first with steamers plying on the Allahabad and Kolkata route in 1834. The steamers were about 120 feet sternwheelers with 40 to 90 nominal horsepower engines, giving a speed of 6 to 7 miles an hour. During rains, when Ganga and its tributaries had sufficient water to allow direct services via Hooghly, it took seven days to reach Allahabad from Kolkata. The discovery of coal mines in Bengal made the steamer services cheaper by about 25 % making travel more economical. Writing about the navigation in Ganga, Johnston states, "The trade was not confined to the produce of the riverine tracts only, but extended in some cases to areas far removed from the rivers when this entailed considerable carriage by road followed by trans shipment. The main example is cotton in Central India wherein no less than 30,000 boatmen found their livelihood from this source. Everyone who had a chance to live on the bank of the Great Ganga, says Major Rennel (1780), was struck by the constant succession of boats, moving up and down the river, never appearing for a moment altogether clear and this was nearly the same at all the seasons and in all places. Commerce and trade were the primary objectives of the East India Company and their unusual attention paved the way for development waterways in the Gangetic system. It was but natural as new areas were acquired; the Company paid the utmost attention to

transportation as a security measure. River navigation was the only means available readily hence it became the greatest beneficiary of the Company's policies and programs. Apart from the traffic by propelled vessels, all the Gangatic Rivers were studded with an array of country boats equally handling large volumes of passenger and cargo traffic. The port of Kolkata contained 10,000 ships built in India. According to J. Johnston, "the volume of the upward and downward trade of the interior, with Kolkata alone by the Gangetic channels was, in 1881, valued at about Rs. 27 crore. At Bamanghata, east of Kolkata, 1,78,627 cargo boats were registered in 1876-77 at Hooghly, 1,24,357and Patna 61,571. These figures, large as they are, represented only a fraction of the total number of boats on all rivers of the Gangetic Plain."

The last quarter of the 19$^{th}$ century marked a turning point in river Ganga's navigation history. The construction of railways between 1855 and 1870 did not adversely affect the riverways and instead, the river traffic increased as waterways transported large quantities of cargo to points nearer the railway lines and the railways further transported the goods to the hinterland. The trunk railway line connecting Allahabad with Kolkata was a major arterial route. During this period of the development of inland navigation, South India was not lagging. The coastal traffic along the Malabar Coast and the backwaters of Kerala had flourished continuously. The Coromandel Coast was bustling with country boats; the rivers like Mahanadi and Godavari were as crucial in the South as the Ganga and its tributaries were in the North. A navigation canal known as the Buckingham Canal that follows the peninsula's eastern coast was constructed as early as 1806. The primary goods for transport were rice, paddy, salt and building materials. The canal is still open today for navigation by smaller crafts. Running parallel to the Eastern

coast, its central portion lies in the State of Andhra Pradesh and a portion of Tamil Nadu. It is connected to the Cannanur canal of the Krishna Delta, which is associated with the Godavari Delta canals. It thus makes a continuous stretch of navigable channel of about 451 miles along the eastern coast. Subsequently however the river traffic gradually declined and culminated in the final debacle in the first quarter of the 20th century. The growing popularity of the Grand Trunk Road, reconstructed between 1839 and 1842, threw the first challenge to the waterways.

1.12 The Period of Decline (1850 to 1920 A.D.). Ganga's decline in traffic was first seen in the upper reaches of the river and its tributaries due to the significant diversion of its water to canals constructed between 1825 and 1854. In 1886-87, the Ganga-Ghaghra route to Bengal traffic amounted to 53,25,467 maunds. After two years, it amounted to only 48,16,400 maunds. The decline in cargo boats may be taken as evidence of the setback suffered by Inland navigation. In 1905, the number of cargo boats on Gangetic rivers was 15,194 only, compared to 47,814 plying on Brahmaputra in Assam. By 1910, navigation on the Ganga upstream from Allahabad was rarely undertaken. However, the traffic downstream from Allahabad was still substantial. The 1907 edition of the Gazetteer of Mirzapur District states that the Ganga was navigated by country boats of 100 maunds or even more during the rainy season. As many as 79 wharves were available on both sides of the bank for trans shipment. By 1915, the Uttar Pradesh, Bengal and Assam river ways had shrunk considerably.

1.13 Causes of Decline. The leading reason for the decline of the waterways was the advent and rapid progress of railways in the country under the British. Railways, due to their speed and inland connectivity, while waterways were restricted to the course of

the rivers, made the railways a more sought after option. Due to their technical superiority, the railways enjoyed safer runs than waterways. The railways could also maintain control over the traffic in the area they served and no other means of transportation could compete with them in matters of speed, organization and regularity.

Moreover, the diversion of waters of Ganga and Yamuna to several canals reduced the available draught and navigation was thus reduced. Larger boats and steamers could no longer travel further upstream as they used to do. The cargo had to be brought to the river port on smaller country boats or bullock carts and no organization could handle the traffic between the river ports and the origin and destination points. Railways, on the other hand could pick up and deliver goods at any station, big or small; this facilitated the takeover of traffic by railways from the waterways running parallel to them. The poor organization and management of river services was perhaps the weakest point that led to their downfall.

Another factor that contributed considerably to the decline of waterways was the law and order situation along the river courses. The rapid deterioration of waterways and the consequent unemployment of hundreds and thousands of boatmen earning their livelihood from river traffic turned them into river pirates and dacoits. Organized gangs of dacoits and pirates moved along the riverways in search of possible victims. Life and property on the rivers were unsafe and the criminals made free use of trade boats in the guise of river traders as a cloak for the commission of crime. The rapid increase in the crime on the Ganga River and its tributaries had upset the merchants of the time and it was thus natural for them to turn towards the railways for their goods transportation. In addition, the then government also did not take any significant concrete steps to

reinvigorate the waterways in terms of improving law and order or introducing newer vessels with a shallow draught. It also gave preferential treatment to the development of rail connectivity in the country.

1.14 The Period of Revival (1947 to date). Soon after India attained freedom, the National Government convened a conference of representatives of interest groups concerned to consider ways and means to promote navigation on the river Ganga. The then Minister of Transport stated that the 'Government is interested in co-coordinating all forms of transport river, road and railways and that if the river services are found to be better suited to meet the needs of a particular area, Government would be prepared to consider its development even in preference to Railways or to make Railways coordinate their activities with the river services to enable the two to work in collaboration and that there will be no question of the Railways pulling all the freight away from the river services.' This conference was the starting point for a rethinking of Inland waterways. Subsequently, several conferences were held to discuss the problems connected with the waterways. One of the conferences decided to examine the possibilities of developing the navigational facilities on the Ganga from Buxar to Allahabad. The question was reemitted to a technical sub committee consisting of representatives of the Central Water and Power Commission and representatives of Joint Steamer Companies, for a preliminary survey. In 1950-51, the committee concluded that due to the postponement of the post-war plans for industrial expansion in Uttar Pradesh and the lack of dependable statistics of traffic on the river, there were very few prospects of securing the minimum guaranteed return on the capital outlay. This conclusion was inevitable as the Ganga Valley is a region well served by roads and railways. , However, The committee felt that there might be scope

for running the service as far as Allahabad or Kanpur during the high and middle water season.

With the start of the First Five Year Plan of India in 1951, the development of inland waterways was taken up more seriously. For this purpose, Rs 3.4 crore was earmarked in the First Five Year Plan. During the Second Five-Year Plan, a sum of Rs. 3 crore was allotted and several schemes were undertaken. The most important of which was constructing an inland port at Pandu (Assam). During the Third Five Year Plan, a sum of Rs. 7.5 crore was earmarked for this purpose. The program included a pilot towing project to be undertaken by the Ganga-Brahmaputra Board in Sundarbans, the purchase of dredgers and launchers for Sundarbans and Brahmaputra and the setting up of a central organization to advice on matters relating to inland water transport. Provision was also made to improve and extend the West Coast Canal in Kerala, the Taldana and Kendrapara canals in Odisha and the development of navigational facilities in the Rajasthan Canal. During the Fourth Five Year Plan, Rs. 13 crore was earmarked for developing Inland water transport. The speedy development of inland water transport in the Eastern region, which has excellent scope for growth, depended much on the relationship between India and Pakistan, which was rarely good. The steamers and boats connecting Assam with Kolkata had to pass through what was originally East Pakistan. After the 1965 and Pakistan conflict, these services stopped operating. Further, during this conflict, India lost several steamers and boats that were in Pakistani waters at the time the hostilities began. Thus, the development of inland navigation in this region slowed down and became problematic.

Today, India's inland waterways have immense economic potential, with over 14,500 km of navigable rivers, canals, backwaters and creeks. The establishment of the Inland Waterways Authority of India (IWAI) in 1986 marked a revival of this sector, to develop, maintain and regulate inland waterways for transport and shipping. In recent years, special focus has been placed on developing these waterways. The National Waterways Act of 2016, which expanded the number of National Waterways, is an essential legislative effort in this direction. The Government is also encouraging public-private partnerships (PPP) to attract investment and expertise in the sector. Projects like the Jal Marg Vikas Project (JMVP), funded through the World Bank is aimed at enhancing the navigability of National Waterway-1 (NW-1), thus contributing to trade and tourism and reflects the Government's commitment to revitalizing inland waterways.

# CHAPTER II

# RESEARCH METHODOLOGY

## 2.1 Geographic and Economic Significance of Varanasi in the Jal Marg Vikas Project.

Varanasi, one of the oldest continuously inhabited cities in the world, holds a prominent position in India's cultural, religious and economic landscape. Strategically located on the banks of the Ganga River in Uttar Pradesh, the city has historically been a vital trade and commercial hub. Varanasi is centrally along NW-1, which spans approximately 1,620 km from Prayagraj in Uttar Pradesh to Haldia in West Bengal. This geographic positioning makes Varanasi an ideal point for cargo consolidation, distribution and multimodal connectivity. The city's location at the confluence of various trade routes enables efficient inland transportation, linking northern and eastern India with ports and global markets.

Agriculturally and industry significance also exists as the neighbouring districts of Mirzapur, Bhadohiand, Chandauli are known for their textile, carpet and handicraft industries. At the same time, the larger Purvanchal region contributes significantly to agricultural output, including rice, wheat and fruits. The Ganga River flows through Varanasi and offers a natural channel for inland water transport. The river's depth and flow characteristics make it suitable for cargo vessels, reducing reliance on road and rail transport. The JMVP aims to enhance the navigability of this stretch by ensuring a Least Available Depth (LAD) of 2.2 to 3.0 m, allowing the movement of vessels with capacities between 1,500 to 2,000 Dead Weight Tonnage (DWT). One of the primary advantages of

integrating Varanasi into NW-1 is the reduction in logistics costs. Transportation by waterways is significantly cheaper than road and rail transport. Studies indicate that inland water transport can lower freight costs by up to 30%, benefiting textiles, agriculture and manufacturing industries. The development of cargo handling facilities at the Varanasi terminal ensures faster and more efficient movement of goods, reducing congestion on highways and rail networks.

The improved connectivity through NW-1 has positioned Varanasi as a critical node in the national and global supply chain. The city's direct link to the ports of Haldia and Kolkata enables seamless export of goods to the international markets. Additionally, the integration of Varanasi with the Eastern Dedicated Freight Corridor (EDFC) has further enhanced its role as a logistics hub.

2.2 Statement of Problem. The Jal Marg Vikas Project (JMVP) is designed to bring economic development through improved transportation and connectivity. Given that the Multimodal Terminal (MMT) opened in Varanasi in Nov 2018, its economic impact on Varanasi remains inadequately studied. There is limited research on how infrastructure projects of this magnitude affect the local economy, employment patterns, real estate, tourism and communities. Given the multifaceted nature of these big infrastructure projects and while the overall macroeconomic benefits of the development of inland waterways are clear, this study attempts to study how the JMVP project and the MMT have influenced the economy of Varanasi, as well as identify any challenges and future opportunities it presents.

2.3 Research Objectives. The primary objectives of this research are:-

(a) To assess the overall economic impact of the JMVP on the city of Varanasi.

(b) Analyze the changes in local businesses, trade and employment patterns since implementation of JMVP and the MMT.

(c) Evaluate the impact on tourism and related industries.

(d) To identify the challenges and opportunities presented by the JMVP at Varanasi.

2.4 Rationale of Study. This research examines the economic impact of the Jal Marg Vikas Project and the Multimodal Terminal in Varanasi. Varanasi's adaptation to modern infrastructure projects like the MMT offers a unique case for studying economic development in a city with a deep-rooted history and culture. Understanding the full scope of these big impact projects is essential for maximizing the project's benefits while minimizing any negative consequences.

2.5 Research Methodology. The research has employed a mixed methods approach with a combination of quantitative and qualitative data collection and its analysis. For the research, secondary data was collected from various government reports, papers and inputs from the Ministry of Ports, Shipping and Waterways. Meetings were also held with officials at the Inland Waterways Authority of India, Noida, to gain an insight into the larger context of JMVP and MMT development. The research paper delves into the planning and implementation of the JMVP, emphasizing extensive engagement with diverse stakeholders. The study also involved interaction with key

participants in Varanasi to include the Project Director of the MMT at Ramnagar, the business community of Varanasi, Mallah community and the locals of Varanasi.

To ensure a thorough examination, the research adopted a multifaceted approach the initial phase comprised analyzing secondary data, focusing on planning and implementing the MMT at Varanasi. Subsequently, the study employed a targeted survey methodology. Questionnaires were given to various stakeholders, which provided a ground level insight into the multiple facets and impact of the MMT project at Varanasi.

2.6 Research Questions. The study makes an effort to investigate the following:-

(a) How has the Jal Marg Vikas Project (JMVP) influenced the overall economic growth of Varanasi since its inception?

(b) To what extent has the JMVP affected local businesses in Varanasi? How have small and medium enterprises (SMEs) in Varanasi adapted to the changes brought by the JMVP? What sectors have benefited the most from the JMVP?

(c) How has the JMVP impacted Varanasi's employment rates and job creation?

(d) In what ways has the JMVP influenced the tourism industry in Varanasi?

(e) What socio economic benefits does the local population experience of the JMVP? What are the perceptions of local stakeholders (business owners, residents, government officials) regarding the economic impact of the JMVP?

(f) What opportunities exist for further economic development linked to the project?

2.7 Scope/Limitations/Delimitations. The research focused on the city of Varanasi, examining both the direct and indirect impacts of the MMT as part of the JMVP. The study was limited by the limited time and availability of reliable data, particularly regarding long-term impacts. Additionally, the diverse and complex nature of Varanasi's socio economic environment may make it challenging to isolate the effects of the waterway from other concurrent developments. The research was confined to the Varanasi region and did not extend to other areas along the National Waterway-1. The study focused on the period following the implementation of the JMVP and it did not explore pre-existing conditions in depth.

# CHAPTER III

## LITERATURE REVIEW

3.1 **Gupta, Aditya, Bansal AK and Anand Neeraj (2017) "Inland Waterways Transportation (IWT) in India: Understanding and Meeting Shipper's Service Requirements"** The document offers an extensive analysis of the historical evolution, policy framework, economic significance and challenges associated with the inland waterways system in India. The study examines the historical evolution of inland waterways in India, tracing their origins to the pre-colonial and colonial periods. The authors argue that inland water transport (IWT) was the primary mode for moving goods and people before British rule. With the introduction of railways in the 19$^{th}$ century, the focus shifted away from waterways, resulting in the neglect of this mode of transport. The document discusses the post independence era, during which only limited efforts were made to revive inland waterways. However, these initiatives lacked a systematic approach and faced challenges due to insufficient policy support and infrastructure investment. A significant turning point occurred with the enactment of the National Waterways Act of 2016, which aims to develop and integrate waterways into the broader transportation network. The document highlights the role of various policy initiatives and institutional mechanisms that have influenced the development of inland waterways. The establishment of the Inland Waterways Authority of India (IWAI) in 1986 was a crucial step toward revitalizing the sector. The IWAI was responsible for developing and regulating national waterways, conducting feasibility studies and improving navigability. One of the study's central themes is the economic potential of inland waterways in India.

The authors present compelling arguments for how IWT can reduce logistics costs, enhance trade efficiency and support economic growth. A comparative analysis with road and rail transport underscores the cost effectiveness of waterways, showing that transporting goods via inland waterways is significantly cheaper. Additionally, lower fuel consumption and reduced carbon emissions make IWT a sustainable alternative for freight movement. The authors also emphasize the potential for regional economic integration. Improved inland waterway connectivity could bolster trade with neighboring countries such as Bangladesh, Nepal and Myanmar. The India Bangladesh Protocol on Inland Water Transit and Trade exemplifies successful cooperation with our neighbours. The document identifies key constraints that have hindered the efficiency of IWT, such as a lack of modern terminals, cargo handling facilities and navigational aids. Many waterways continue to languish and remain underutilized due to inadequate infrastructure, seasonal variations in water levels, siltation and seasonal flooding that impacts navigability. The authors highlight the necessity for effective river management and dredging practices to maintain consistent water depths the year round. They also suggest implementing a unified regulatory framework bringing all stake holders together to streamline decision making and project execution in IWT. Furthermore, the paper also seeks to understand the transportation service requirements of Indian shippers, the various factors influencing their mode of transportation choice and how IWT in India can realign itself to meet these specific requirements in the future.

3.2 **Mishra Amit, Saxena Alipt and Khanapuri V.B. (2020) "Evaluating Development Opportunities for Inland Water Transport in India"** The paper looks at the available navigable waterways in India. It examines the cost of transporting goods by waterways, viz. and other modes of transportation. Using secondary data about the cost of transportation through IWT between various feasible geographical locations in India, a relationship between cost per ton and distance travelled in km was estimated. This relationship also considers the parameters related to the availability of night navigation and mechanized handling at ports. This paper also focuses on connectivity between NW-1 and NW-2 through the waterways of Bangladesh and presents the benefits of its use. A case has been studied to substantiate how NTPC and the cement industry can help each other to reduce the total cost through collaboration and avail themselves of the benefits of two way navigation. Based on the study, it was found that night navigation facilities are available in almost all the national waterways. The study suggests that the fixed cost of transportation per ton for one-way navigation can be reduced by 20.6% if the handling of goods on terminals is mechanized. Furthermore, improvising from one-way navigation to two-way navigation reduces the variable cost of transportation by 50% and fixed cost by 16%. The fixed cost of transportation can further be reduced by handling goods on terminals for two-way navigation. This paper provides companies with an approach to have a qualitative and quantitative comparison between various available modes of transportation with IWT for selected routes.

3.3 **Lok Sabha Secretariat, Parliament Library and Reference, Research, Documentation and Information Service (LARRDIS) (2015) "Development of Waterways in India"** The paper examines the country's extensive network of rivers and canals. It emphasises that, despite studies of the five significant waterways and examinations of various policy frameworks for rejuvenating this sector, the underutilization is attributed to inadequate infrastructure, lack of modernization and policy neglect. It identifies infrastructural deficiencies, siltation and dredging needs, multiplicity of authorities and environmental concerns as significant challenges. It advocates public-private partnerships (PPPs) that encourage private sector participation in developing and operating waterway infrastructure to leverage investment and expertise. Development of multimodal transport hubs seamlessly connecting waterways with road and rail networks to enhance logistical efficiency. It recommends incorporation of modern technologies for navigation, cargo handling and real time monitoring to improve safety and efficiency and streamline regulatory frameworks to facilitate faster project approvals and implementation. It recommends a more proactive role by various agencies of the Government as a provider, facilitator and regulator.

3.4 **Chawla Vasudha (2016) "India's Emerging Quest to Develop Inland Waterways"** The article comprehensively analyzes India's renewed focus on leveraging its waterways for economic and strategic benefits. The author underscores the financial benefits of Inland Waterways Transport (IWT), highlighting its cost effectiveness, fuel efficiency and environmental friendliness. The author notes that transportation costs via waterways are approximately ₹0.25 per km, compared to ₹1.50 by rail and ₹2.50 by road. Despite these advantages, inland waterways account for only 0.4% of the total cargo

movement in India. The brief emphasises the potential of IWT to reduce logistics costs and its positive impact on local communities through regional development. The author also delves into the historical context, current initiatives and prospects of IWT in India, highlighting the Government's efforts to transform waterways into viable transportation corridors. The article does not dwell on the economic impact on the local populace due to the development of the national waterways.

3.5 **CUTS International (2017) "Expanding Tradable Benefits of Inland Waterways Case of India"** The report explores the potential and challenges associated with inland waterways in India. It assesses the economic, social and environmental benefits of developing this sector while highlighting policy recommendations for better utilization. This review critically examines the report's findings, methodology and implications in the broader context of India's transportation infrastructure and trade logistics. The report's primary objective is to evaluate the trade and economic benefits of inland waterways in India. It aims to identify the existing status and potential of inland waterways in India, assess the financial and trade benefits derived from enhancing waterway transport, examine policy and regulatory frameworks governing inland waterways and analyze challenges in the development and utilisation of this sector. The report employs a mixed-method approach, combining secondary research and case study analysis. It utilizes data from government sources, trade bodies and policy documents to build an evidence-based argument for expanding inland waterways. Comparative analysis with other successful inland waterway models, mainly from Europe and China, highlights the best practices India could adopt. The key findings include the cost effectiveness of (IWT) which is significantly cheaper than road and rail transport. It looks at reducing the

logistics costs, which account for about 13-15% of India's GDP. It examines the infrastructure deficiency of inadequate ports, terminals and navigational aids, which hinder efficient waterway transport. Silting and seasonal fluctuations in water levels create further operational challenges. Regulatory bottlenecks in multiple regulatory agencies and overlapping jurisdictions slow decision making and insufficient incentives and regulatory clarity discourage private participation in the sector. In addition, poor integration with road and rail transport networks reduces the efficiency of IWT.

The document provides a roadmap for infrastructure development, regulatory and policy reforms, integration with other transport modes, financial and incentive mechanisms and addressing environmental and social concerns. While the CUTS International Report provides a comprehensive analysis of India's inland waterway potential, its few limitations include heavy reliance on secondary sources and limited primary data. While the report highlights economic benefits, a quantitative cost benefit analysis comparing different transport modes would strengthen its arguments. The impact on local communities, particularly displacement and livelihood concerns, is not examined.

3.6 **Verma Pooja, Joshi Kanchan, Singh R.K. (2019) "River Projects on the Ganges: Their Impact and View of the Local Populace of Varanasi"** The study explores the impact of river projects on the Ganges, focusing on the perceptions and experiences of the local populace in Varanasi. The paper analyzes the environmental, socio economic and cultural implications of infrastructure projects along the river while assessing public sentiment and concerns. This review critically evaluates the study's methodology, key findings and impact, highlighting its strengths and limitations in river

management and urban development discourse. The primary objectives of the research are to examine the various river projects implemented along the Ganges in Varanasi, to assess their environmental, economic and social impact, to understand the perspective of the local community regarding these developments and to identify key challenges in sustainable river management and propose recommendations.

The study employs a mixed methods approach, incorporating both qualitative and quantitative data. The methodology includes interviews and questionnaires with residents, boat operators and small business owners. Review government reports, policy documents and previous research on river projects. Examine specific infrastructure projects such as renovating Ghats, sewage treatment plants and riverfront development initiatives.

The key findings show that despite initiatives like the Namami Ganga Project, pollution levels in the river remain high due to untreated sewage discharge and industrial effluents. The construction of embankments and dams has altered aquatic ecosystems, leading to a decline in native fish populations and affecting livelihoods dependent on fishing. River engineering projects have disrupted the natural sedimentation process, impacting the hydro-dynamics of the Ganges. Local boatmen and traders have faced economic challenges due to restricted river access and displacement caused by development projects. While the beautification of Ghats and riverfront development has boosted tourism, the benefits are not equitably distributed among local communities.

Policy and governance challenges include a lack of community involvement, leading to residents' resistance and dissatisfaction. While pollution control and river conservation policies exist, enforcement mechanisms remain weak. Multiple government agencies

overseeing river projects often result in inefficiencies and overlapping responsibilities. Budget constraints and corruption in implementation processes have hindered the effectiveness of conservation and development projects.

Recommendations for sustainable river management include incorporating local voices in planning and decision making processes through stakeholder consultations. Strengthen industrial waste disposal and ensuring strict compliance and expanding treatment facilities and promoting decentralized sewage management. Promoting livelihoods through skill development and alternative employment opportunities is a way forward.

The research by Verma, Joshi and Singh provides a comprehensive analysis of river projects on the Ganges and their impact on the local populace of Varanasi. While development initiatives have improved infrastructure and tourism, environmental degradation, displacement and cultural disruptions persist. The study underscores the need for participatory governance, sustainable policies and equitable economic benefits to ensure river projects align with development and conservation interests.

3.7 **KPMG's 2014 "Report on Water Transportation in India"** The 2014 report by KPMG on water transportation in India offers a comprehensive analysis of the country's inland waterways and coastal shipping sectors. The study underscores the untapped potential of water transportation as a cost effective and environmentally friendly alternative to the overburdened road and rail networks. The report details the existing infrastructure of India's inland waterways, including major rivers and canals. It highlights the limited utilization of these waterways despite their vast potential for cargo and passenger movement. It looks at challenges in terms of infrastructure, regulatory policies

and funding. It advocates for substantial investment in dredging, port modernization and navigational technology. Suggests policy reforms to streamline regulations and encourage public-private partnerships. The report recommends the development of multimodal logistics hubs that integrate water transport with road and rail. While the report provides recommendations, it lacks a detailed roadmap outlining the steps for implementation. The study also does not consider the perspectives of local communities and smaller industry players affected by water transportation policies.

3.8 **Dharmadhikary Shripad and Sandbhor Jinda (2017) "National Inland Waterways in India: A Strategic Status Report"** The report by Dharmadhikary Shripad and Sandbhor Jinda provides a critical analysis of the National Inland Waterways (NIW) program in India. The study analyzes the strategic importance of inland waterways in India's transport sector. It assesses the economic, social and environmental implications of the National Inland Waterways program. It delves into the key infrastructural and regulatory challenges hindering the effective implementation of the waterways. The report also suggests policy measures for optimizing the benefits of inland water transport (IWT) while mitigating associated risks. The report employs a multi-disciplinary approach, incorporating both qualitative and quantitative analyses. It incorporates policy analysis, case studies, stakeholder interviews and a comparative analysis of similar systems in Europe and China. The key findings include the cost effectiveness of IWT compared to other transport modes. The lack of infrastructure development and intermodal gaps has prevented the optimum utilization of the IWT. Disruption of fragile river ecosystems and pollution may lead to significant environmental issues in the long run. The study recommends coordination among all

stakeholders, infrastructure development to include multimodal terminals, better connectivity, involvement of local stakeholders and cutting down the bureaucratic hurdles to enable the IWT to release its full potential.

3.9 **Sriraman S. (2010) "Long-Term Perspectives on Inland Water Transport in India"** In the article published in the *RITES Journal*, S. Sriraman offers a comprehensive analysis of the long-term prospects of inland water transport (IWT) in India. The paper delves into the historical context, current challenges and future potential of IWT, emphasizing its significance in the nation's transportation infrastructure. The article highlights the historical importance of inland waterways in India. The author examines the existing conditions of India's inland waterways, pointing out the vast rivers and canals that remain largely untapped. He discusses the limited freight movement on these waterways and the lack of modern infrastructure to support efficient navigation. The article examines the challenges regarding the lack of infrastructure, regulatory issues, competition from other modes and financial constraints. The article does not delve into specific strategies for implementation, including timelines and stakeholder roles. There is limited discussion on how revitalizing IWT would affect local communities, especially those dependent on waterways for their livelihoods.

3.10 **Misra RP (2017) "Inland Water Transport in India"** This book traces the development of inland water transport in India. It analyses the cause of the decline of this form of transportation. It examines the cost benefit of IWT's transportation of goods and covers the project's revival through various government initiatives. The book is based on secondary information from multiple sources, including official reports of the central and

state governments. It discusses the problems and prospects of rehabilitating the inland waterways in India. Also, it looks at planning and development, reviews past plans and suggests a way forward for an integrated approach to developing IWT in India.

3.11 **Soni Abhishek and Sinha A.K. (2020) "An Overview on Indian Inland Waterways"** The paper dwells into the vast network of waterways in India and investigates the potential growth and constraints in inland water transportation in India. It highlights that studies show that inland waterways are known to be the most cost effective and fuel efficient mode of transportation. It carries out a comparison of Indian inland waterways with those of China, USA and Europe and Bangladesh. The paper presents detailed insights about the dynamics of Inland Water ways in India and also analyses the government policies regarding development of inland waterways.

# CHAPTER-IV

## CURRENT STATUS OF INLAND WATERWAYS IN INDIA

4.1 Status of Inland Waterways in India. India has a vast network of 20,236 km of navigable waterways, which includes 17,980 km of rivers and 2,256 km of canals. However, only 2,000 km of this network is currently used for mechanised transport. This underutilisation reflects the need for infrastructural development, policy reforms and technological advancements to make inland waterways a more significant component of India's transportation system.

4.2 Inland Waterways Authority. The Inland Waterways Authority of India (IWAI) is a statutory body established by the Government of India under the Inland Waterways Authority of India Act, 1985. It was formally constituted on 27th October 1986 under the Ministry of Ports, Shipping and Waterways. The IWAI is responsible for developing, regulating and maintaining inland waterways in India. The authority undertakes various projects and initiatives to improve water based transport and ensure sustainability. The primary objectives of IWAI are:-

(a) Development of National Waterways. One of the IWAI's primary functions is to develop, regulate and maintain National Waterways (NWs) nationwide. India has 111 declared National Waterways, of which several are operational for cargo and passenger transport. IWAI undertakes projects such as dredging, river training and fairway development to ensure these waterways are navigable throughout the year. It also implements safety regulations and guidelines to facilitate smooth and secure transport operations on these waterways.

(b) Infrastructure Development. To make inland waterways more efficient, IWAI is actively developing essential infrastructure such as terminals, jetties, navigational aids and river ports. These facilities improve cargo handling and passenger movement, reducing logistical costs. IWAI also promotes using modern barges and vessels with improved fuel efficiency and capacity. Developing multimodal terminals, such as the Varanasi Multimodal Terminal (MMT) under the Jal Marg Vikas Project (JMVP), is a key step in boosting water based logistics.

(c) Technological Advancements in Waterway Navigation. To improve the efficiency and safety of inland navigation, IWAI incorporates modern technologies such as River Information Systems (RIS), GPS based navigation aids and Automatic Identification Systems (AIS). These technologies help in real time vessel tracking, enhancing navigation safety and operational efficiency. IWAI is also working on eco friendly vessel designs, LNG-based barges and digital platforms for cargo tracking to make the inland waterways sector more advanced and competitive.

(d) Dredging and Depth Maintenance. Maintaining adequate water depth is crucial for the smooth movement of vessels. IWAI conducts regular dredging and depth maintenance operations to ensure year round navigability. By maintaining a minimum fairway depth, IWAI enables larger vessels to operate efficiently, reducing the cost per ton of cargo transported. The JMVP, supported by the World Bank, is a significant initiative focusing on improving depth maintenance along the Ganga (NW-1), ensuring seamless cargo movement from Varanasi to Haldia.

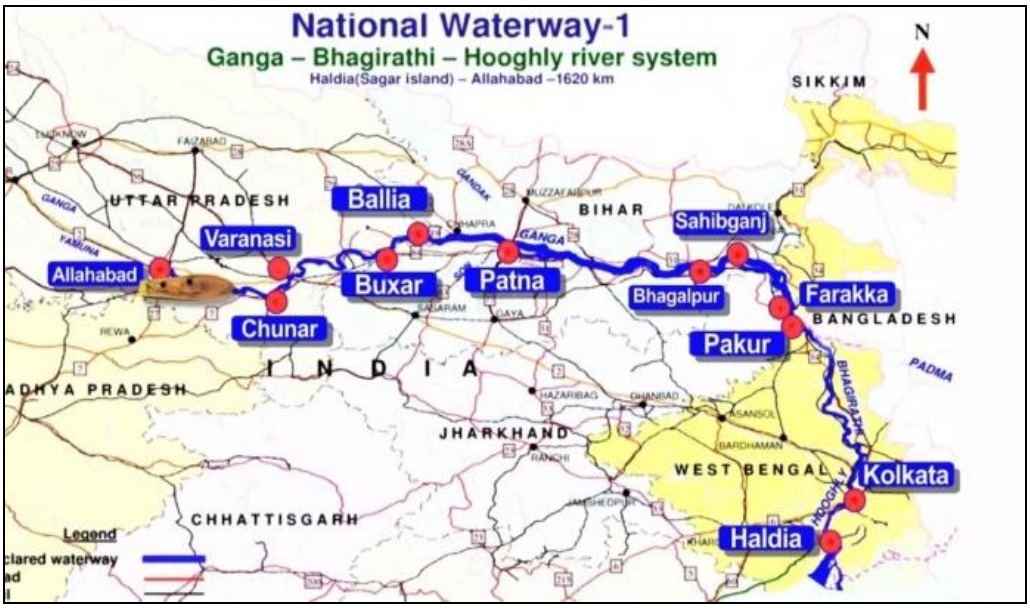
(e) Environmental Sustainability and Green Transportation. One of the IWAI's key focus areas is reducing the environmental impact of transportation. Inland water transport is significantly more fuel efficient and less polluting than road and rail transport. Inland water transport is generally more cost effective than road and rail, especially for bulk commodities over long distances. According to the Planning Commission of India, transporting one ton of freight over one km is approximately Rs 1.36 by road, Rs 0.85 by rail and Rs 0.35 by waterways. IWAI is also exploring using LNG powered vessels, solar powered navigation aids and sustainable dredging techniques to minimize ecological damage. Additionally, it works on projects to revitalize river ecosystems and ensure that waterway development does not harm aquatic life

4.3 National Waterways. The National Waterways Act of 2016 is a landmark legislation in India's transportation sector that aims to revolutionize inland water transport. Enacted by the Government of India, the Act designates 111 rivers, canals and stretches of waterways as National Waterways (NWs), expanding the scope of water based transport across the country. The Act is crucial for reducing road and rail transport dependence, lowering logistics costs and promoting environmentally sustainable cargo and passenger movement modes.

Before the National Waterways Act of 2016, India had only five acknowledged National Waterways under separate legislations. The Act consolidates and streamlines the legal framework, enabling the Inland Waterways Authority of India (IWAI) to develop waterways systematically. The major National Waterways in India are as follows:-

(a) National Waterway 1 (NW-1). The Ganga-Bhagirathi-Hooghly River system is the longest national waterway in India, stretching from Haldia in West Bengal to Prayagraj in Uttar Pradesh over 1,620 km. This waterway connects major industrial hubs and can handle large volumes of cargo.

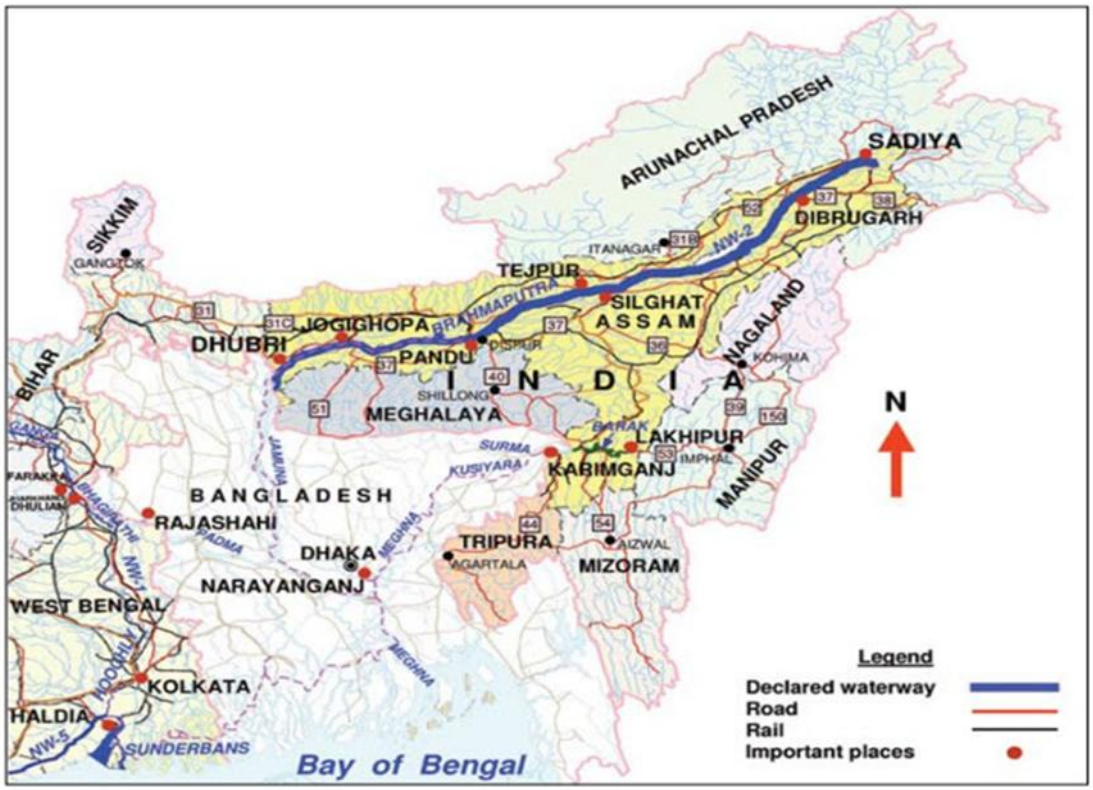
**Figure 4.1: Map showing National Waterway 1**




**Source: Insights of India**

(b) National Waterway 2 (NW-2). The Brahmaputra River, flowing from Dhubri to Sadiya, covers a distance of 891 km. It is a crucial waterway in the northeast region, providing connectivity for Assam and Arunachal Pradesh. This water way connects with NW-1 through Bangladesh.

**Figure 4.2: Map showing National Waterway 2**




**Source: Insights of India**

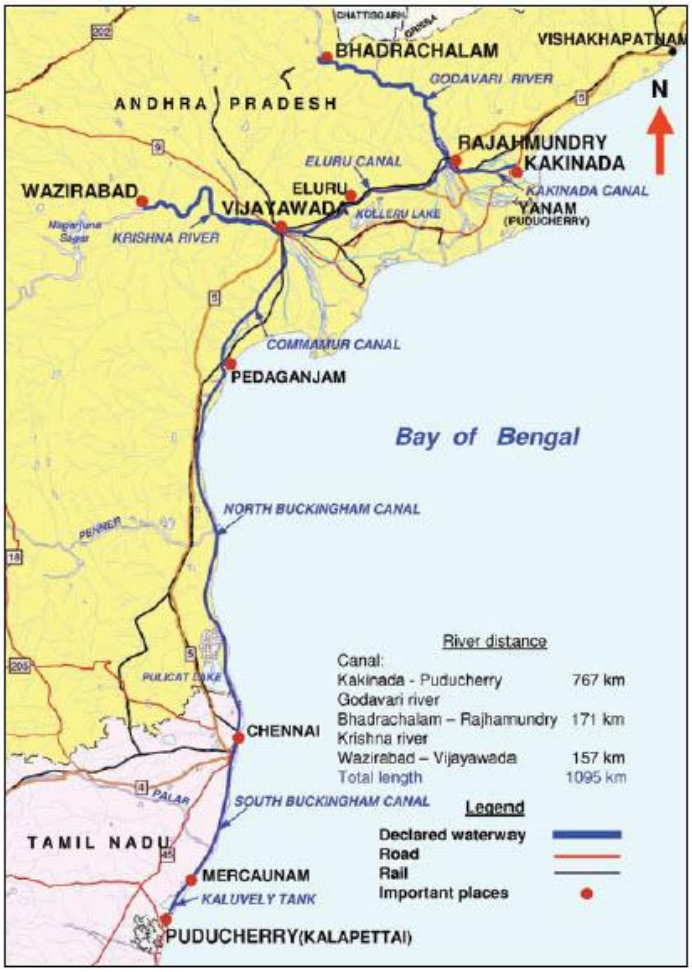
(c) **National Waterway 3 (NW-3)**. This West Coast Canal in Kerala connects Kollam to Kottapuram and covers a distance of 205 km. It is a vital waterway for the movement of goods and passengers in the region.

**Figure 4.3: Map showing National Waterway 3**


**Source: Insights of India**

(d) National Waterway 4 (NW-4). The Godavari and Krishna Rivers and some canal systems form this waterway covering 1,095 km in Andhra Pradesh, Telangana and Tamil Nadu.

**Figure 4.4: Map showing National Waterway 4**




**Source: Insights of India**

(e) National Waterway 5 (NW-5). This waterway connects Odisha and West Bengal through the Brahmani and Mahanadi Rivers, with a length of 588 km.

**Figure 4.5: Map showing National Waterway 5**


**Source: Insights of India**

4.4 Jal Marg Vikas Project and National Waterway-1. The Jal Marg Vikas Project is an ambitious initiative spearheaded by the Government of India to develop and enhance the navigability of National Waterway-1. Historically, NW-1 has been a crucial trade route, supporting commerce and transport in the region for centuries. The initiative seeks to modernise and revive this critical waterway to align with India's economic growth and infrastructural development strategies. NW-1 spans the Ganga-Bhagirathi-Hooghly river system, covering approximately 1,620 km from Prayagraj in Uttar Pradesh to Haldia in West Bengal. JMVP for capacity augmentation of NW-1 from Haldia to Varanasi was approved by the Cabinet Committee on Economic Affairs on 3rd February 2018 at a cost of Rs 5369.18 crores. The estimated cost of JMVP of Rs. 5369.18 crore (US$ 800.00 million) is to be utilised as per the following funding pattern:

(a) IBRD Loan. Rs.2,512 crores (US$ 375.00 million).

(b) Government of India Counterpart Funds (budgetary allocation and proceeds from issue of infrastructure bonds: Rs. 2,556 crores (US$380.00 million).

(c) Private sector participation under PPP mode: Rs. 301 crores (UDS$ 45.00 million).

The project envisions establishing a sustainable and efficient inland water transport system, which promises to reduce congestion on road and rail networks, lower transportation costs and foster economic development in the region. Detailed Feasibility Environmental & Social Impact Assessment and Market Development Strategy Studies were carried out on NW-1 in December 2016, February 2017 and November 2017 to determine the development strategy on NW1. Further, the detailed engineering for key infrastructure projects such as Varanasi MMT, Haldia MMT, Sahibganj MMT, IMT Kalughat and Farakka Lock were prepared by the Engineering consultation subsequently. The following mandatory clearances were obtained in connection with the implementation of JMVP:

(a) Clearance under the Wildlife Protection Act, 1972 for passage of vessels through the Kashi Turtle Sanctuary, Varanasi

(b) Coastal Regulation Zone clearance for the Haldia multimodal terminal.

(c) Clearances from the Ministry of WR, RD & GR and for the navigation lock at Farakka.

Consequent to the review held on 10th February 2020, the estimated cost of JMVP was revised to Rs. 4,633.81 crores from the original estimated cost of Rs. 5,369.18 crores, thereby giving a saving of Rs. 735.51 crores (USD 109.78 million) in the total project cost. The savings comprise of Rs. 387.10 crores (USD 57.78 million) from the IBRD loan component and Rs. 348.41 crores from the counterpart fund component. The revised cost estimate also included several activities aligned to the Arth Ganga Concept estimated to cost Rs. 746.00 crores. As a result, the IBRD loan component got reduced to USD 317.22 million. The project implementation, including the work on activities aligned to the Arth Ganga Concept, was initially planned to be completed by December 2023. Extension of Jal Marg Vikas Project upto 2026 was requested. The World Bank has given an extension till 25 December 2025.

4.5 Objectives of JMVP. The JMVP has clearly defined objectives to improve India's inland water transport infrastructure. The primary aim is to enhance the navigability of NW-1 to facilitate the seamless movement of vessels with capacities ranging from 1,500 to 2,000 Dead Weight Tonnage (DWT). This requires ensuring a Least Available Depth (LAD) of at least 3 m along the waterway for smooth and safe navigation. The key objectives are enumerated below:-

(a) One of the primary objectives of the JMVP is to enhance the transport efficiency along NW-1. By increasing the waterway's navigability, the project aims to facilitate the movement of large cargo vessels while reducing transit delays and operational inefficiencies. This improvement is expected to create a seamless transport network to optimise supply chains and provide a cost effective alternative to existing transport modes. By developing NW-1 into a viable mode of transport,

the project seeks to provide an economical, energy efficient and environmentally friendly alternative to road and rail transportation. This shift is expected to reduce the pressure on existing transport networks and improve overall logistical efficiency in the region. Additionally, JMVP seeks to facilitate the seamless movement of goods and passengers by addressing bottlenecks and inefficiencies in the current transport systems.

(b) Another significant objective is to boost regional development by creating a robust inland water transport system. The JMVP aims to contribute substantially to the region through which NW-1 traverses by generating employment opportunities, fostering trade and commerce and improving the mobility of goods and people. Enhanced connectivity is anticipated to galvanise industrial development and attract regional investments. Industries near NW-1 are expected to benefit from reduced logistics costs and better market accessibility.

(c) Reducing logistics costs is a critical focus of the project. Inland water transport is more cost effective than road and rail transport, especially for bulk goods. The project is expected to benefit industries such as agriculture, steel, cement and fertilizers by lowering transportation expenses, which rely heavily on cost efficient logistics. According to estimates, transport costs via waterways can be up to 60-80% lower than road transport, making it an attractive alternative for businesses.

(d) The JMVP also strongly emphasises environmental safeguards. Inland water transport is significantly more energy efficient and environmentally

sustainable than other modes of transport. By promoting the use of waterways, the project aims to reduce greenhouse gas emissions, thereby contributing to India's broader SDG goals. Studies have shown that rivers emit only a fraction of the CO2 produced by road and rail transport per ton km of cargo transported.

4.6 Scope of the Project. The scope of the JMVP encompasses a wide range of components aimed at creating a comprehensive infrastructure and support system for inland water transport. The fairway development under the JMVP involves achieving specific depth targets along different stretches of NW-1 to enable the navigation of vessels of varying sizes. The stretch from Haldia to Barh is planned to have a Least Available Depth (LAD) of 3m, while the stretch from Barh to Ghazipur is targeted at a LAD of 2.5m. The stretch from Ghazipur to Varanasi aims for a LAD of 2.2m. These depth targets are achieved through dredging and other river conservancy measures, ensuring a navigable channel with the required depth and width. Advanced dredging techniques and machinery are being employed to achieve these targets efficiently.

The development of multimodal multi modal terminals is another critical component of the project. These terminals are being constructed at strategic locations along NW-1 to facilitate seamless cargo transfer between waterways, railways and roadways. The Varanasi terminal, located at Ramnagar in Uttar Pradesh, has a handling capacity of 1.26 million metric tons per annum (MMTPA). This terminal serves as a crucial hub for trade, handling a diverse range of goods, including agricultural products, industrial raw materials and manufactured goods. It has modern container handling facilities; dedicated warehousing spaces and mechanized loading and unloading systems to ensure efficient cargo operations. Inaugurated on 12$^{th}$ November 2018, this terminal is connected to

National Highway 7 (NH-7). It is expected to be linked to the Eastern Dedicated Freight Corridor (EDFC) through rail connectivity from the Jeonathpur railway station. This connectivity will enhance the terminal's capacity to handle large cargo volumes efficiently. The terminal has mechanised loading and unloading systems which significantly reduces turnaround times.

The Sahibganj terminal in Jharkhand boasts a handling capacity of 3.03 MMTPA. It was inaugurated on 12$^{th}$ September 2019 and is connected to National Highway 80. Plans are underway to establish rail connectivity from the nearby Sakrigali Railway Station, further enhancing the terminal's operational efficiency and connectivity. The terminal's design incorporates eco friendly technologies to minimise environmental impact.

The Haldia terminal in West Bengal has a handling capacity of 3.08 MMTPA. Inaugurated on 13$^{th}$ January, 2023, it is strategically located to connect with major road networks and has provisions for future rail connectivity. This terminal is expected to facilitate trade and commerce in the region. The terminal also features cold storage facilities, enabling the transport of perishable goods.

The construction of a new navigational lock at Farakka in West Bengal is a key infrastructural development under the JMVP. This lock is designed to enable the smooth passage of vessels across the Farakka Barrage, which previously posed a challenge to uninterrupted navigation. The lock will incorporate state of art hydraulic systems, allowing for precise control of water levels and ensuring safe and efficient vessel movement through this critical juncture. This lock is designed to facilitate the smooth passage of vessels across the Farakka Barrage, eliminating a major bottleneck and

improving the overall navigation efficiency along the waterway. The lock is engineered to accommodate large boats and has advanced safety features to ensure uninterrupted navigation.

Modern navigational aids are being installed along the NW-1 to enhance safety and operational efficiency. These include channel marking, day and night navigation facilities and implementing a state of art River Information System (RIS). These measures ensure vessels safe and efficient movement along the river by providing real time information on vessel traffic and river conditions. The RIS includes GPS based vessel tracking, automated distress alerts and collision avoidance systems.

Another critical aspect of the project is the construction of roll-on/roll-off (Ro-Ro) terminals. These terminals are designed to facilitate the transportation of vehicles across the waterway, reducing road congestion and promoting the use of inland waterways for vehicle transportation. This initiative is expected to enhance logistical efficiency and significantly reduce transportation costs. For example, transporting vehicles via Ro-Ro terminals will cut manufacturers' delivery times and operational costs.

Under the JMVP-II (Arth Ganga) initiative, 61 small community jetties are being developed to promote socio economic development along the banks of the Ganga. These jetties will support local economic activities by providing essential facilities such as berthing spaces, passenger waiting halls and connectivity to nearby roads. They are expected to improve livelihoods and foster regional economic growth. Additionally, these jetties are anticipated to enhance tourism and recreational activities, boosting local economies.

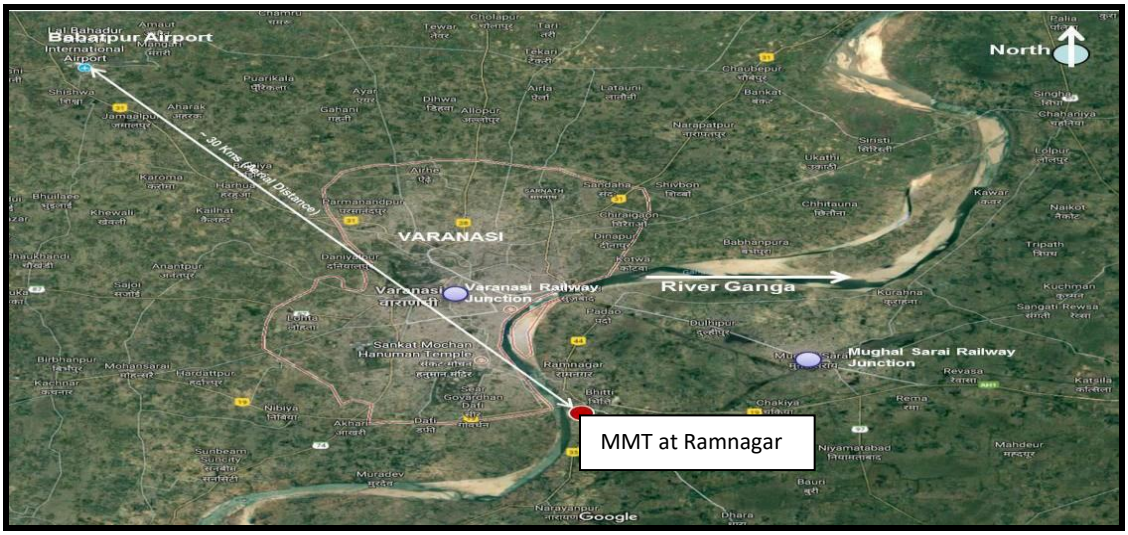
4.7 Progress of the Project. Officials acknowledged that JMVP has made significant strides in recent years. Key infrastructure, such as multi modal terminals and fairway development, has been implemented to enhance cargo movement. Navigation infrastructure, including RIS, night navigation facilities and channel marking, is gradually being deployed to ensure safer and more efficient transport. Additionally, certain stretches of NW-1 have been dredged to maintain minimum navigable depths, facilitating vessel movement. However, while the physical infrastructure has improved, the adoption of waterway transport by businesses and industries remains sluggish, necessitating further efforts in awareness building and policy support.

Establishing cargo hubs, warehouses and other ancillary infrastructure is integral to the project. These facilities ensure the seamless handling and storage of goods, enhancing the overall efficiency of the inland water transport system. Additionally, integrating NW-1 with railways, highways and ports is a key focus area for creating a multimodal transport network that maximizes efficiency and minimises costs. The cargo hubs are planned to have modern technologies such as automated inventory management and real time tracking systems.

4.8 Multi-Modal Terminal. The Indian transport system comprises of various modes, viz. Railways, Roadways, Inland Waterways, Coastal Shipping and Airways. The main modes of transport are rail and road, which are currently overburdened and are experiencing congestion. Inland Water Transport (IWT) is a fuel efficient, environment friendly and cost effective mode of transport that has the potential to supplement the overburdened rail and congested roads. The Multi Modal Terminal at Ramnagar, Varanasi, is located on the eastern side of the Ganges at a distance of 9 km upstream of

Malviya road cum Railway Bridge connecting Varanasi to Mughalsarai at Latitude 25°15'12.4" North and Longitude 83°01'50.3" East at Varanasi in Uttar Pradesh. IWT terminal is south of Viswa Sundari Setu (NH-2) and is 650 m from the existing NH-7 and the existing Airport at Babatpur lies 30 km aerial distance from the site. It is built on a **33**.34 hectare site along the Ganga River.

**Fig 4.6: Location of Site of Multi Modal Terminal**




**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

Considering the restriction in the availability of the waterfront, a maximum of five berths is proposed to be developed. For Phase 1, development of two berths was undertaken. The following commodities have been considered as the targeted cargoes and the individual berth capacities for handling the targeted commodities have been worked out as given below:

(a) Bagged and General Cargo. Bagged and General Cargo, such as food grains, vegetables, agricultural produce, jute, cloths, cement and fly ash will

come to the terminal by barges and be unloaded by MHC cranes into trucks and transported to the covered shed. Then, it will be loaded onto trucks and transported to the hinterland by trucks or rail.

(b) Bulk Cargo. Natural aggregates like sand, stone chips, soil, consumer goods, etc., will come to the terminal by barges and will be unloaded by MHC cranes into trucks hoppers or mobile hoppers and transported to the storage yard by conveying systems or trucks. Then they will be loaded into trucks by payloaders and transported to the hinterland by trucks or rail.

(c) Containers. Containers will come to the terminal by barges and be unloaded by MHC cranes into trucks and containers in the container yard will be loaded into trucks by reach stackers and transported to the hinterland by trucks.

The traffic potential of Varanasi MMT, as provided by M/s Hamburg Port Consulting GmBH, the traffic consultant, is presented below:

**Table 4.1: Traffic Potential at Varanasi MMT**

| **Cargo in Tons** | **2020** | **2025** | **2035** | **2045** |
|---|---|---|---|---|
| Bagged | 1.40 | 1.50 | 3.31 | 3.37 |
| Container | 0.16 | 0.17 | 0.19 | 0.21 |
| Dry Bulk | 0.14 | 0.15 | 4.25 | 4.34 |
| General Cargo | 0.66 | 0.69 | 0.74 | 0.75 |
| Neo-Bulk | 1.13 | 1.23 | 1.27 | 1.29 |
| Ro-Ro | 0.05 | 0.05 | 0.35 | 0.36 |
| Liquid Bulk | 0.01 | 0.01 | 0.01 | 0.01 |
| **Total** | **3.55** | **3.82** | **10.12** | **10.32** |

**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

Berths. The first berth has been developed as a multi cargo berth for handling bagged food, consumer bulk cargo, project cargo and containers. The length of the berth-1 is 200m and the width is 35m. The berth is continuous, with a backup yard with slope protection under the berth. In the final phase, an additional berth is proposed to cater to future traffic requirements. In addition to the main high level cargo jetty, the terminal also has a floating pontoon jetty for passenger vessels, indicating an ability to handle river cruise ships or ferries. The dimensions of the proposed additional berth are 300m in length and 35m in width. The berth capacity as proposed for development in phases is as listed below:

**Table 4.2: Proposed Berth Capacity for Development at MMT, Varanasi**

| Commodity | Phase 1a | | Phase 1b | | Phase 1c | |
|---|---|---|---|---|---|---|
| | No. of berths | Traffic in MTPA | No. of berths | Traffic in MTPA | No. of berths | Traffic in MTPA |
| Construction Material Bulk | | 0.21 | | 0.31 | | 1.53 |
| Consumer Goods Bulk | 2 | 0.08 | 2 | 0.17 | 5 | 0.14 |
| Containers | 0.04 | 0.04 | 0.06 | 0.08 | 0.08 | 0.06 |
| Food and food stuff Bagged | | 0.25 | | 0.35 | | 0.25 |
| **Total** | **2** | **0.58** | **2** | **0.81** | **5** | **1.98** |

**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

The types of vessels designed to operate at the MMT are given below:

**Table 4.3: Types of Vessels to Operate at the MMT, Varanasi**

| Vessel Type | Vessel Size (DWT) | LOA (m) | Beam (m) | Loaded Draft (m) |
|---|---|---|---|---|
| Barge | 3000 DWT | 95 | 15 | 2.5 |
| Barge | 2,000 DWT | 80 | 11 | 2.5 |
| Barge | 75 TEU | 80 | 11 | 2.5 |

**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

The terminal is equipped with modern cargo handling gear, including two mobile harbour cranes for loading and unloading cargo between barges and the shore. There are open storage yards and transit sheds/warehouses for stacking containers or bulk goods under cover. The design also incorporates parking areas and internal roads for trucks, facilitating smooth transfer of goods between road vehicles and the terminal. To ensure smooth operations support infrastructure such as lighting, communication systems, administrative building sand a worker amenity center are in place.

External Road Connectivity. A two lane road of 650m in length has been constructed in Phase-1A, which is proposed to be widened to a four lane road in the Master Plan. An additional four lane road is also proposed in the Master Plan on the other side of the Railway track to provide better accessibility to the terminal. The terminal has good connectivity with the national highways network. The nearest national highway from the terminal is NH-7, which runs parallel to the river on the eastern side. Another national

highway is NH-2, which connects Allahabad to Aurangabad through Varanasi. The site lies at the intersection of these two national highways. The terminal is about 650 m (proposed access road) from NH-7. Further to the east, NH-2 connects the terminal to Buxar, Ballia, Chhapra, Sonepur and Patna. The site location concerning National Highways is shown in the figure below. The bypass bridge is on NH2, which is also a part of the Delhi-Kolkata part of the Golden Quadrilateral. The site concerning the road network is shown in the below figure.

**Figure 4.7 Road connectivity for Varanasi Multimodal IWT Terminal**


**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

Rail Connectivity. The terminal also has good connectivity with the railway network. The nearest railway station is Jeonathpur Railway Station, which is about 3.75 km by road. Mughal Sarai Junction and Varanasi Junction are about 14 km and 17 km by road, respectively, from the proposed site of the terminal. The layout shall allow a rail line inside the terminal so that rail connectivity to the nearest railhead can be achieved suitably. In order to transport large quantities of bulk cargo through rail, it is proposed to have rail connectivity within the IWT premises, taking off from the DFC (Eastern)

corridor with the proposed new Jeonathpur cabin and connectivity to IR at Jeonathpur station, Mughalsarai- Allahabad section in Allahabad division of north central railway. The length of the rail connectivity line from takeoff from DFC near Jeonathpur to the IWT terminal is 5.1Km and to the R&D yard beyond the takeoff is 2km. The proposed alignment crosses through agricultural lands, irrigation canals, village roads, some stretches of the built up area and NH-7. The site concerning the railway network is shown in the figure below.

**Fig 4.8: MMT Site and Railway Network**


**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

Air Connectivity. The nearest airport is Lal Bahadur Shastri International Airport, Babatpur in Varanasi which is about 37 km by road from the project site.

Inauguration and Operation. The Varanasi MMT was inaugurated and dedicated to the nation by PM Modi on 12th November 2018. The maiden commercial shipment handled was a containerized cargo from PepsiCo, India wherein 16 truckloads of snack foods

transported by barge from Kolkata to Varanasi. This barge (MV *Rabindranath Tagore*) took about 9-10 days to cover the 1,390 km voyage and on return carried fertilizers from IFFCO's Phulpur plant (near Prayagraj) back downriver. This round trip demonstrated the terminal's capability to handle two-way container traffic**.** IWAI, as the owner, at present operates the terminal, coordinating vessel movements, cargo handling and maintenance.

**PM Modi over seeing the shipment of cargo at MMT, Varanasi**


**Source: PIB, India**

Financial Analysis. The financial analysis of the Multi Modal Terminal at Varanasi, a crucial component of the Jal Marg Vikas Project, has been conducted by M/s Hamburg Port Consulting GmBH, a reputed international consultancy firm specialising in port and maritime infrastructure. The analysis was carried out to assess the project's financial viability, sustainability and long term profitability over a 30 year operational period. Various financial indicators, including capital costs, operating expenditures, revenue

generation potential and financial internal rate of return (IRR), were evaluated to determine the project's economic feasibility. Seeing the benefits of IWT, the financial model assumes steady growth in cargo volumes. The matrix below provides the details:

**Table 4.7: Financial Analysis of MMT, Varanasi**

| **Year** | | | | **1** | **6** | **11** | **16** | **21** | **26** | **30** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **2017** | **2018** | **2019** | **2024** | **2029** | **2034** | **2039** | **2044** | **2048** |
| Project Cost | Millions of INR | 885 | - | | | | | | | |
| Cargo in Million Tons | Million Tons | - | - | 0.78 | 1.301 | 2.576 | 3.852 | 3.852 | 3.852 | 3.852 |
| Revenues | | | | | | | | | | |
| Cargo Revenues | Millions INR | | | 147.80 | 274.34 | 654.17 | 980.82 | 1082.90 | 1195.61 | 147.80 |
| Storage Revenues | Millions INR | | | 66.78 | 122.88 | 330.78 | 508.82 | 561.78 | 620.25 | 671.38 |
| Vessel Revenue | Millions INR | | | 0.68 | 1.30 | 3.20 | 5.01 | 5.81 | 6.73 | 7.58 |
| Total Income | Millions INR | | | 215.26 | 398.53 | 988.15 | 1494.65 | 1650.49 | 1822.59 | 1973.12 |
| Operating Expenses | | | | | | | | | | |
| Electricity Cost | Millions INR | | | 5.79 | 6.72 | 24.48 | 28.37 | 32.89 | 38.13 | 42.92 |
| Fuel Cost | Millions INR | | | 3.62 | 6.98 | 16.50 | 25.61 | 29.68 | 34.41 | 38.73 |
| Other Labour Cost | Millions INR | | | 11.96 | 37.02 | 102.87 | 200.20 | 255.51 | 326.11 | 396.38 |
| Manpower Cost | Millions INR | | | 16.44 | 20.98 | 39.39 | 50.27 | 64.16 | 81.88 | 99.53 |
| Equipment Hiring Cost | Millions INR | | | 24.50 | 28.41 | 65.86 | 76.35 | 88.51 | 102.61 | 115.49 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Insurance @0.75% of Project Cost | Millions INR | | | 1.39 | 1.54 | 4.61 | 4.61 | 4.61 | 4.61 | 4.61 |
| Maintenance Cost | Millions INR | | | 28.54 | 30.54 | 110.46 | 110.46 | 110.46 | 110.46 | 110.46 |
| Total Expense | Millions INR | | | 92.24 | 132.18 | 364.17 | 495.87 | 585.83 | 698.22 | 808.12 |
| EBITDA | Millions INR | | | 123.02 | 266.35 | 623.98 | 998.77 | 1064.65 | 1124.37 | 1165.00 |
| Cash Flow before Tax | Millions INR | (885) | (885) | 123 | 266 | 624 | 999 | 1065 | 1124 | 1165 |
| IRR ( PRE – TAX) | | 12.24% | | | | | | | | |
| **NPV** | **Millions INR** | **+58.39** | | | | | | | | |

**Source: Detailed Project Report of Multi Modal Terminal at Varanasi**

The Financial Internal Rate of Return (IRR) was calculated as part of the financial assessment to determine whether the investment would yield a positive return over the projected 30-year period. The IRR is a crucial indicator that reflects the potential profitability of the project. The positive IRR indicates that the project is expected to generate enough revenues to cover costs and yield profitable returns over its operational lifetime.

# CHAPTER V

## STUDY AREA AND FINDINGS

5.1 Varanasi: A Strategic Node in the Jal Marg Vikas Project. Varanasi, is one of the oldest continuously inhabited cities in the world and it is not just a cultural and spiritual hub but also a crucial economic and logistical center. A World Bank pre feasibility study found Varanasi to be a suitable site for development as a logistical hub as the city is located strategically and is a focal point in the logistics chain of Eastern Transport Corridor of India where the National Waterways-1, Eastern Dedicated Freight Corridor (EDFC), National Highway-7 and National Highway-2 pass through. Recognizing its importance, the Government of India (GoI) has positioned Varanasi as the central node in the Jal Marg Vikas Project (JMVP), a project aimed at enhancing navigation along National Waterway-1 (NW-1) from Haldia in West Bengal to Varanasi in Uttar Pradesh. The Multi Modal Terminal (MMT) in Varanasi serves as the linchpin of the project, linking inland water transport with road and rail connectivity, thereby creating a seamless logistics ecosystem.

Geographical and Economic Centrality. Varanasi's location in the heart of northern India makes it a pivotal trade junction. It is positioned at a natural confluence of major transport networks, linking Eastern India (West Bengal, Bihar, Jharkhand) to Northern and Central India and hinterland states like Madhya Pradesh and Rajasthan to coastal trading hubs like Kolkata. By integrating Varanasi into National Waterway-1, the JMVP has the potential to transform the city into a multi-modal logistics hub, reducing

dependency on road and rail transport while offering a cost effective alternative for cargo movement.

Economic Significance of Varanasi in JMVP. Varanasi has historically been a centre of trade and industry, dealing in textiles, agricultural products and small scale manufacturing. The Multi-Modal Terminal (MMT) in Varanasi acts as a major gateway for exports and imports, connecting businesses in Uttar Pradesh, Bihar, Jharkhand Madhya Pradesh with domestic and potential international markets. Key economic contributions include:

(a) Boosting Agricultural Trade. The Ganga basin supports extensive agricultural activities, producing crops like rice, wheat, sugarcane and pulses. The MMT in Varanasi facilitates the efficient transport of these products to national and global markets.

(b) Strengthening Manufacturing & Handicrafts. Varanasi is renowned for Banarasi silk, carpets, wooden toys and brassware. The terminal provides cheaper and faster shipping options, allowing local artisans and SMEs to expand their reach.

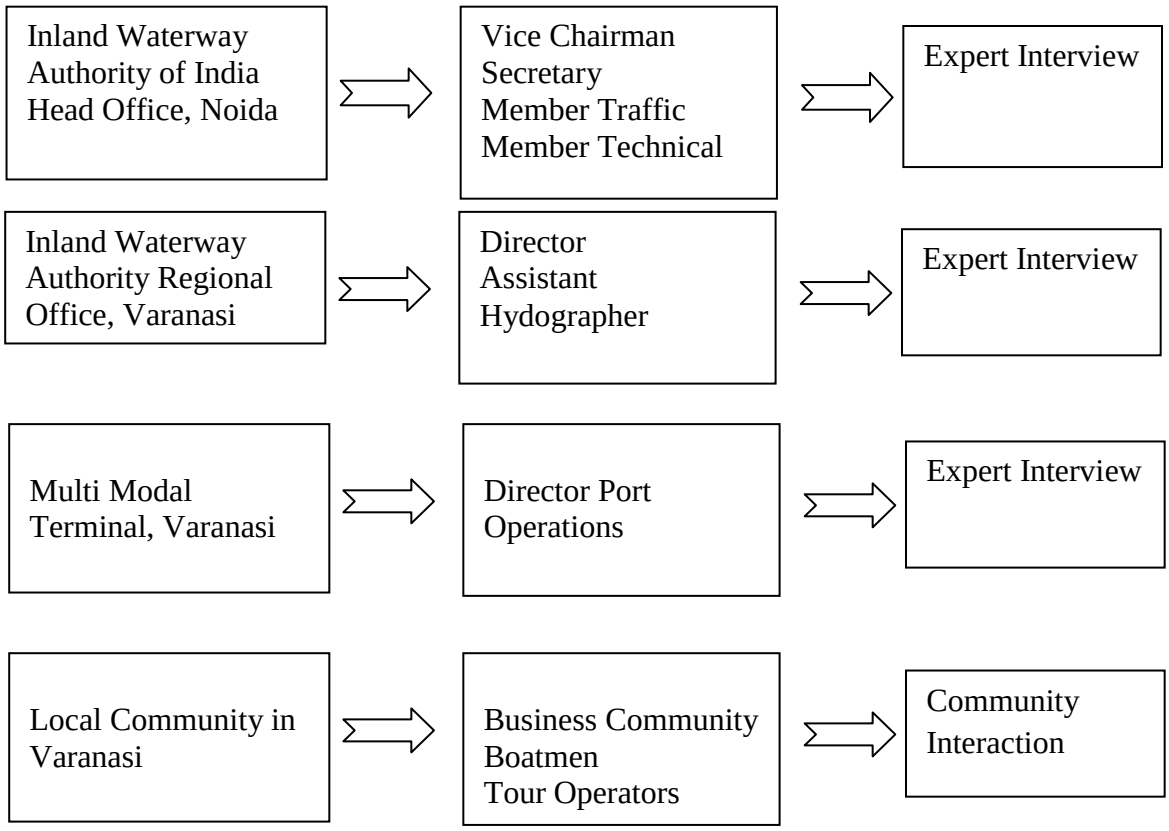
(c) Enhancing Industrial Growth. Proximity to Varanasi's industrial clusters and new freight corridors encourages industries to utilize inland waterways for bulk cargo movement, reducing logistical costs.

Varanasi's central role in the Jal Marg Vikas Project (JMVP) underscores its significance as a trade and logistics hub for northern India. The Multi-Modal Terminal (MMT) at Varanasi not only facilitates cost effective cargo movement but also drives regional

economic growth, industrial expansion and sustainable transport development. As the project continues to expand, Varanasi stands poised to become a model for inland waterway driven development, contributing significantly to India's economic and environmental sustainability goals.

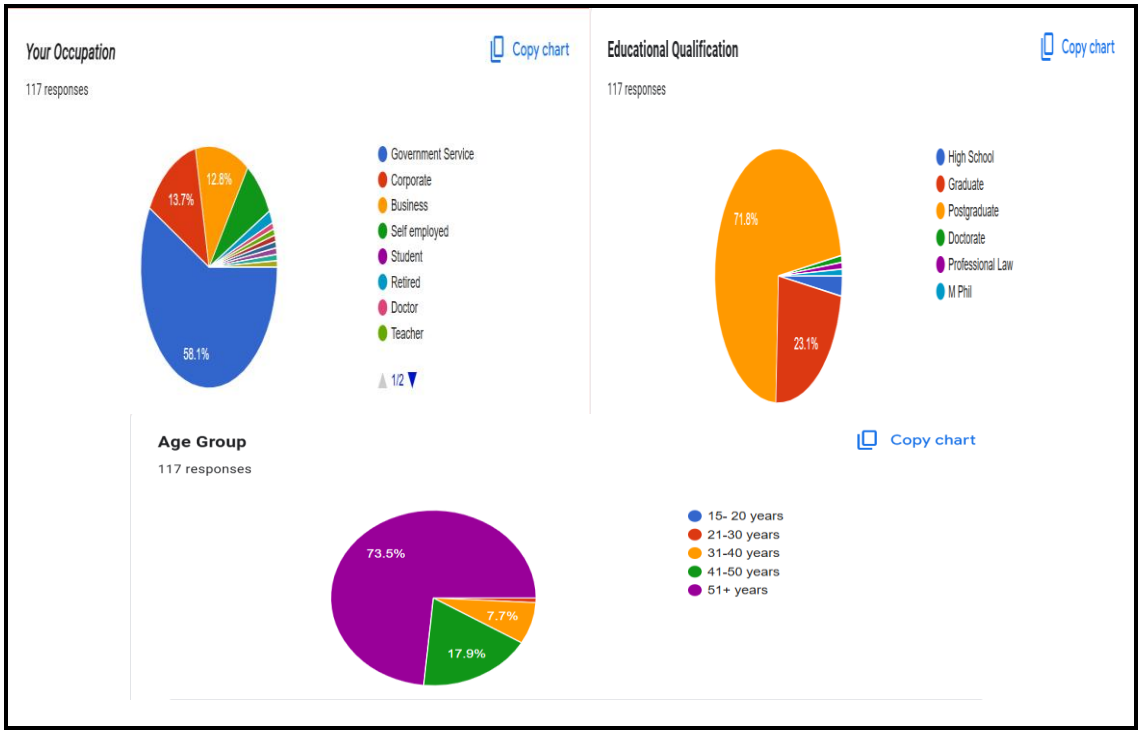
This chapter presents the findings of the comprehensive study conducted to evaluate the economic impact of the JMVP and MMT on the city of Varanasi. Through surveys, structured interviews and focus group discussions, insights were gathered from officials at Inland Waterways Authority of India, Noida and the MMT at Varanasi alongwith interaction with the business community, Mallah community and the locals.

**Figure 5.1 Tools and Techniques for Data Collection in Field Visit**



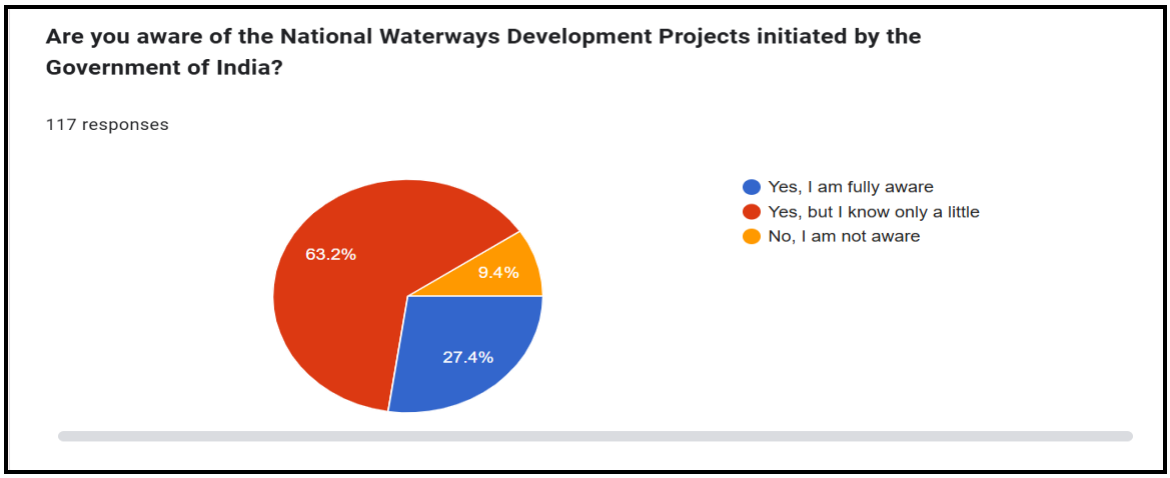

5.2 A widespread survey was undertaken to include all relevant stakeholders viz Government officials, local business community, tour operators, traders, corporate and Armed Forces personnel. A total of 117 responses were garnered. The findings and deductions of the survey are appended below:

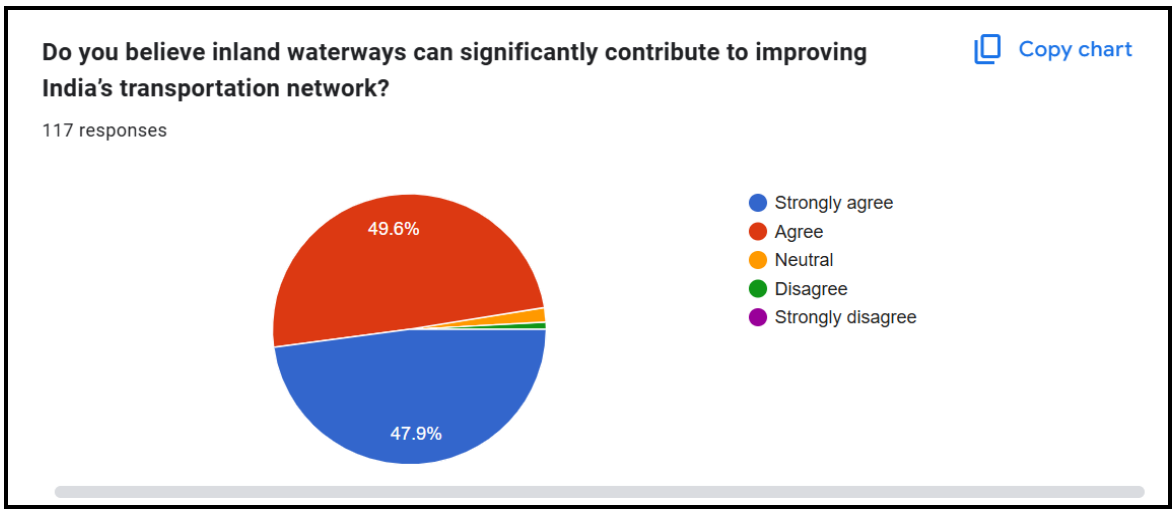
**Figure 5.1: Snapshot of Respondents of Surveys**

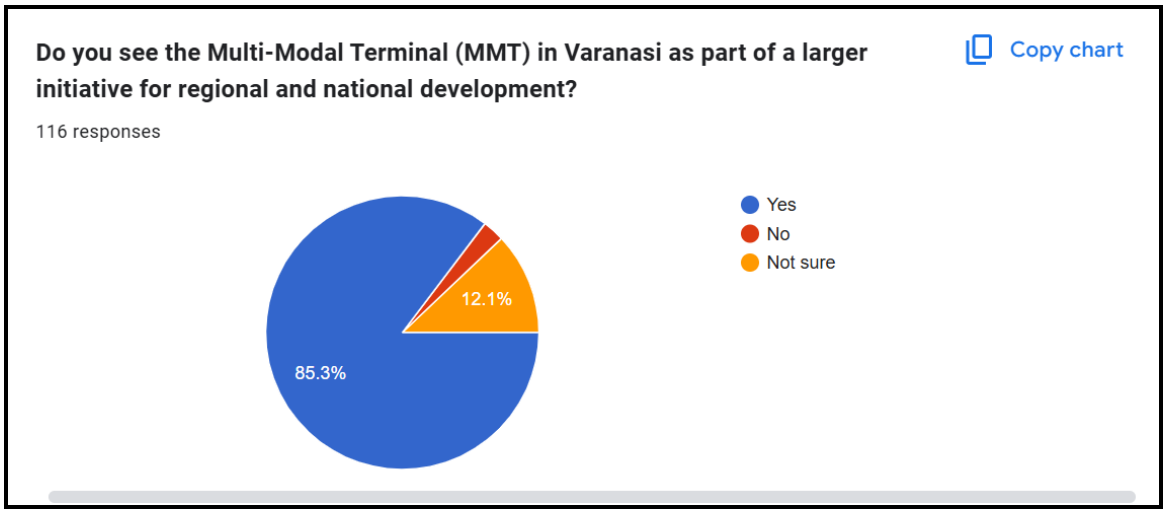


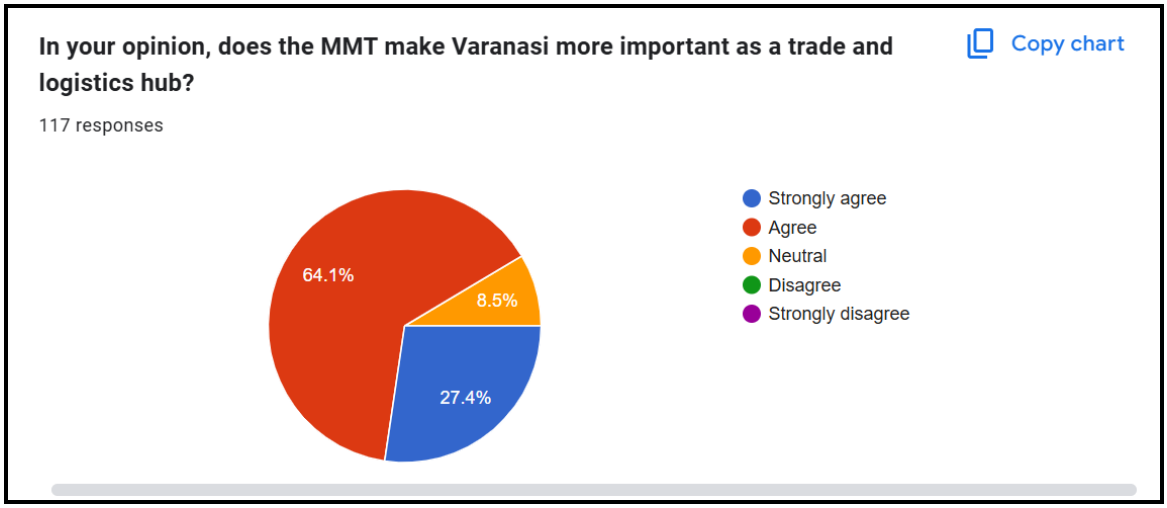
5.3 Awareness and General Perception of National Waterways. Majority of the respondents in the survey had a broad idea of the National Waterways, the JMVP and the MMT at Varanasi. Majority the respondents believe that inland waterways can significantly contribute to the development of transportation network and also view the MMT at Varanasi as part of a larger initiative for development and agree that the MMT will enable Varanasi to become an important trade and logistic hub. Pie charts given below, amplify the same:

**Figure 5.2 Views on Awareness and Perception of National Waterways**



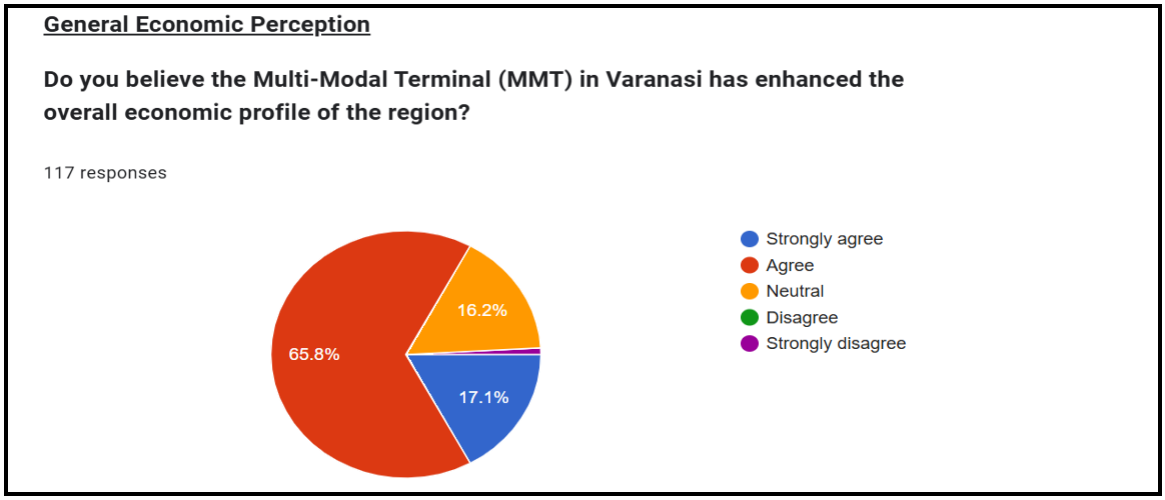


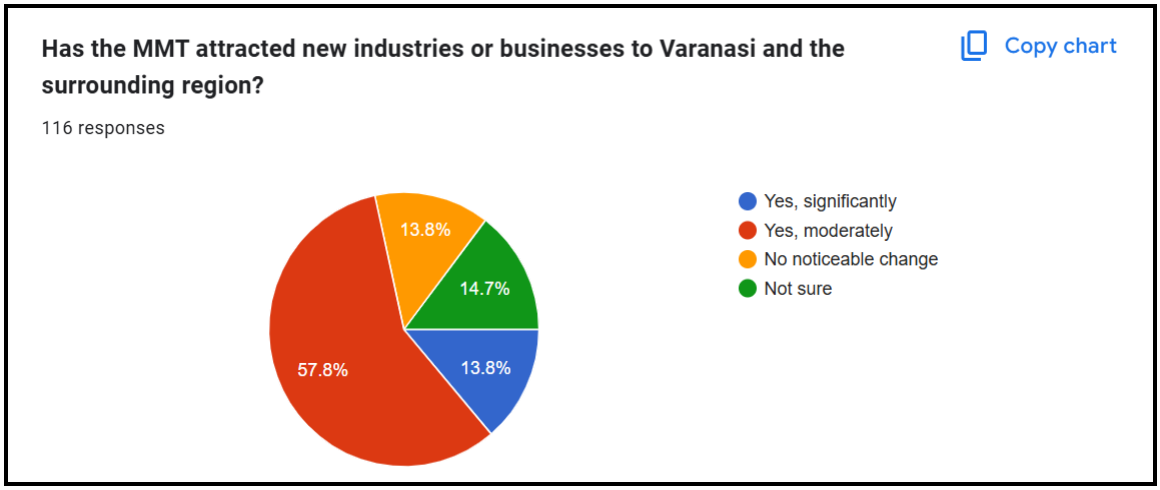




5.4 Economic Impact of JMVP and MMT at Varanasi. Majority of the respondents in the survey believe that the Multi-Modal Terminal (MMT) in Varanasi since its inauguration in 2018 and subsequent operation has enhanced the overall economic profile of the region and agree that the MMT has moderately attracted new businesses in the region. They also feel that once the MMT operates to its full capacity, it will further increase investments in Varanasi and the region. Majority respondents believe that JMVP has positively impacted the trade and logistics sector along with tourism. In addition manufacturing, retail and agribusiness has also seen some benefits of the

project. Majority of respondents agree that reduced market cost of transportation of goods will increase the market share for local businesses. Pie charts amplifying the same are given below:

**Figure 5.3 Respondents Views on Economic Impact of JMVP and MMT**

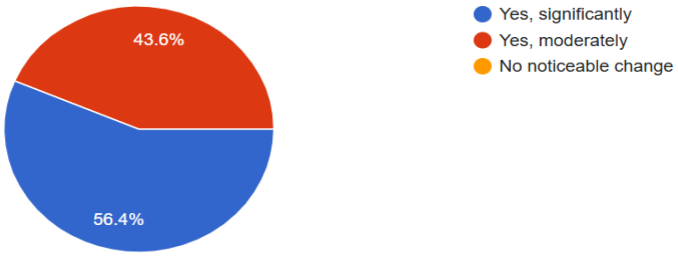


**Do you think the development of the MMT will encourage investments in related infrastructure (e.g., roads, warehouses)?**

Copy chart

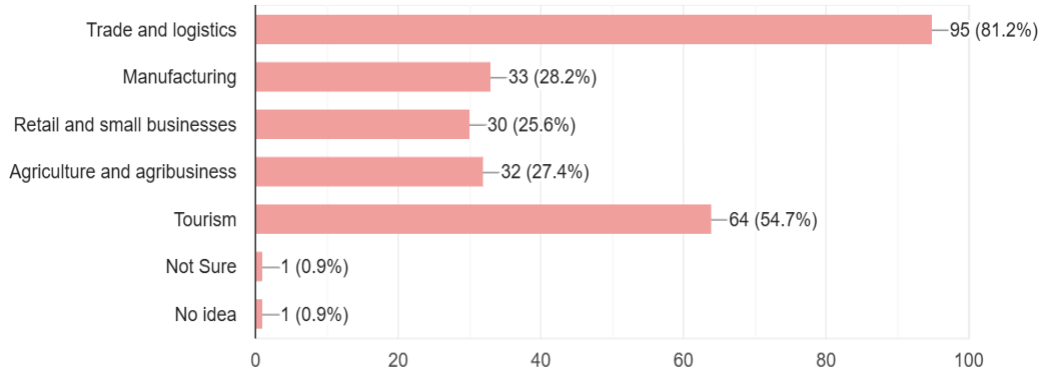
117 responses




**In your opinion, which sectors have benefited the most economically from the MMT?** (Select all that apply)

Copy chart

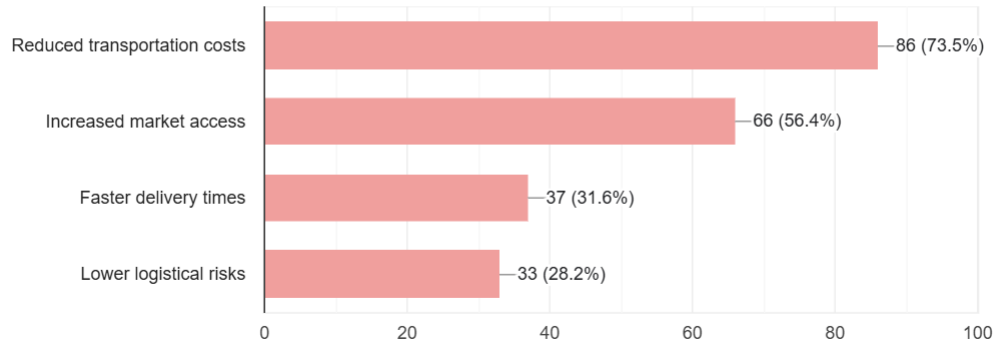
117 responses




**What specific benefits do you think that MMT provides to businesses in the region?** (Select all that apply)

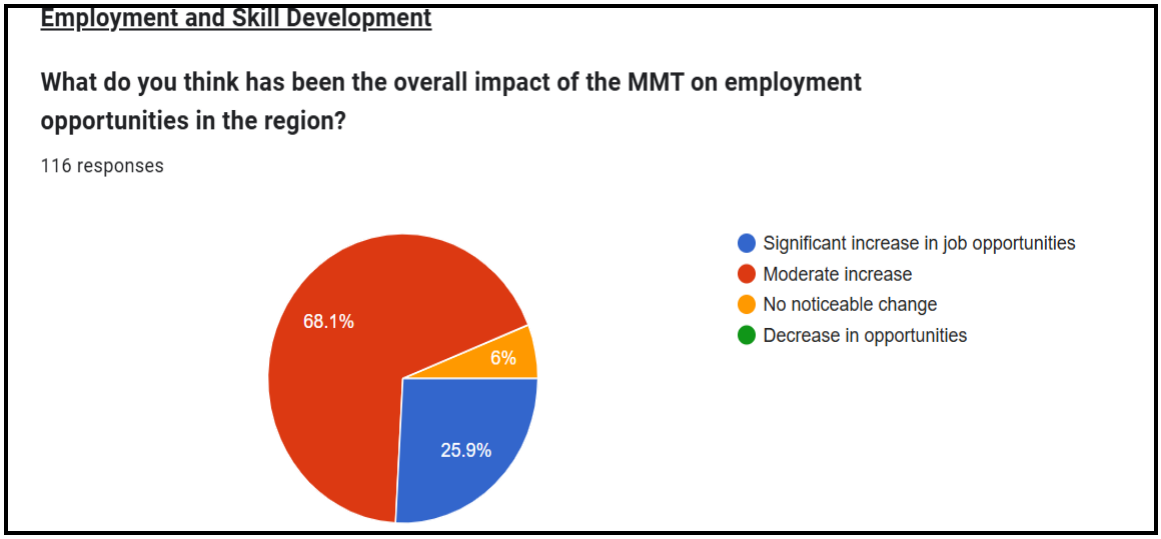
Copy chart

117 responses



5.5 Employment and Skill Development. Majority of the respondents believe that the JMVP along with the construction and operationalisation of the MMT have had a positive impact on the employment opportunities in the region. Logistics, warehousing and transportation services have derived the maximum benefit. A moderate increase in real estate prices has also been witnessed, specifically for warehousing and storage units. Further development of the MMT will attract more investments and new businesses in the region thus directly enhancing employment opportunities and bringing economic benefits to the local community and the region. Manufacturing and construction materials sectors have seen an increase in their business. Pie charts given below amplify the same:

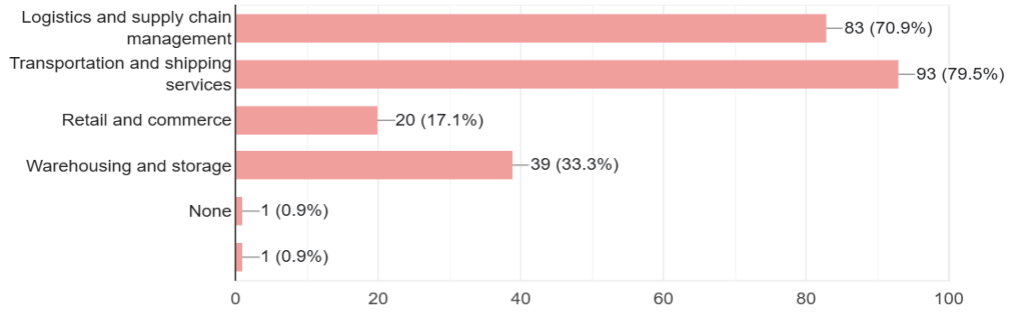
**Figure 5.4 Respondents Views on Employment and Skill Development**



**In which sectors do you think that most jobs have been created or impacted by the MMT?** (Select all that apply)

Copy chart

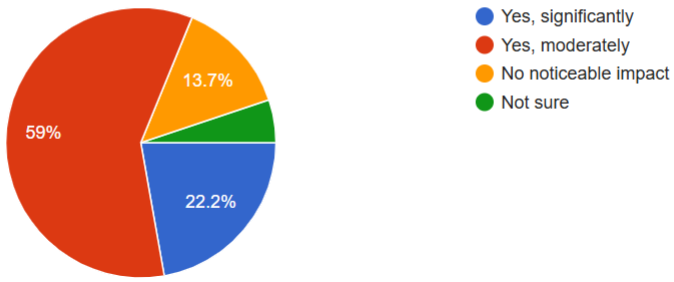
117 responses




**Do you think the MMT has encouraged skill development or training programs in the region?**

Copy chart

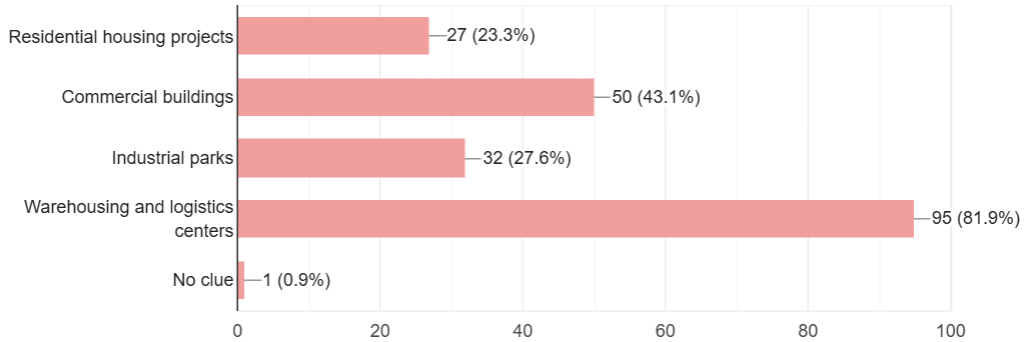
117 responses




**What kind of real estate developments have been influenced by the MMT in the region?** (Select all that apply)

Copy chart

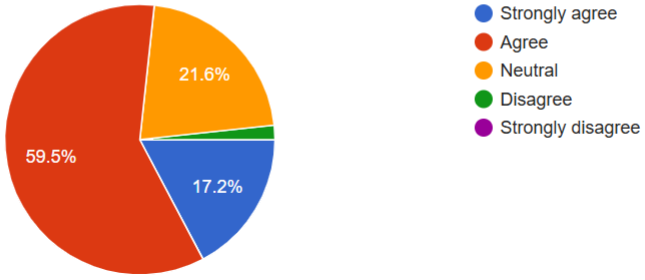
116 responses



**Do you believe the MMT has made Varanasi more attractive for external investors?**

Copy chart

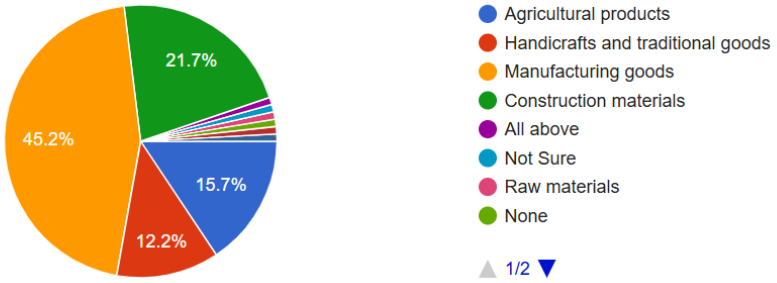
116 responses




**In your opinion what types of goods or services have seen the most growth due to the MMT's connectivity?**

Copy chart

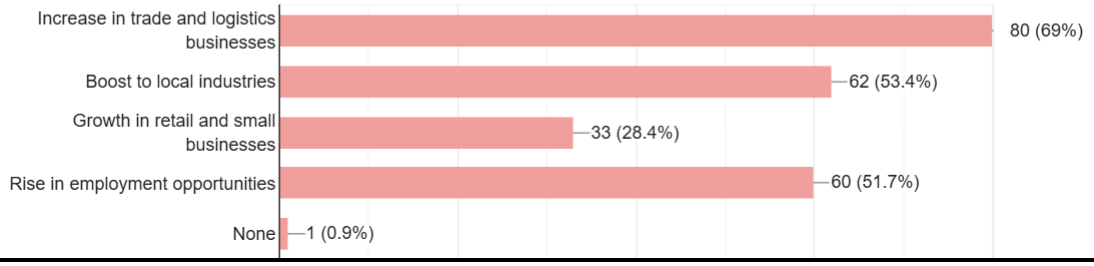
115 responses

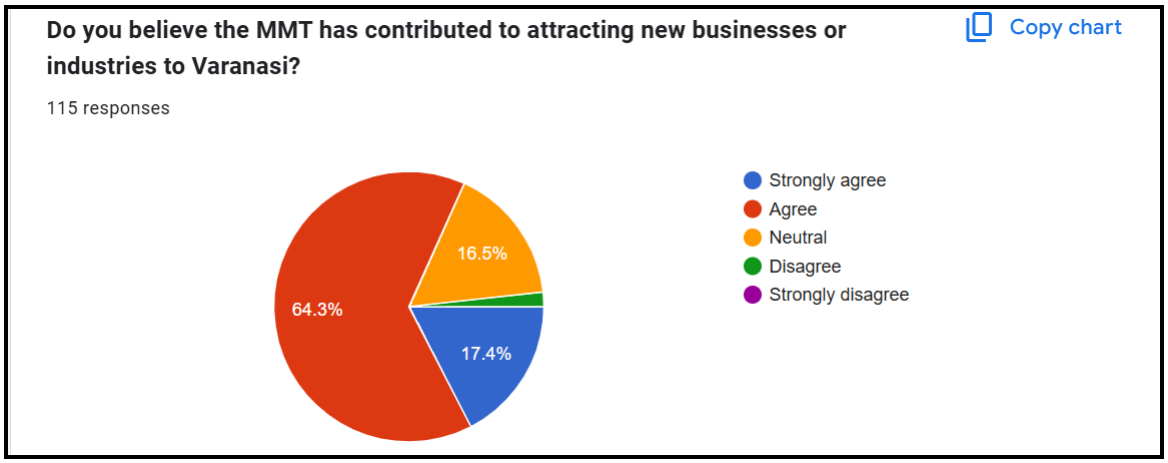



**Community-Level Economic Impact**

**What type of economic changes do you think has MMT contributed to?** (Select all that apply)

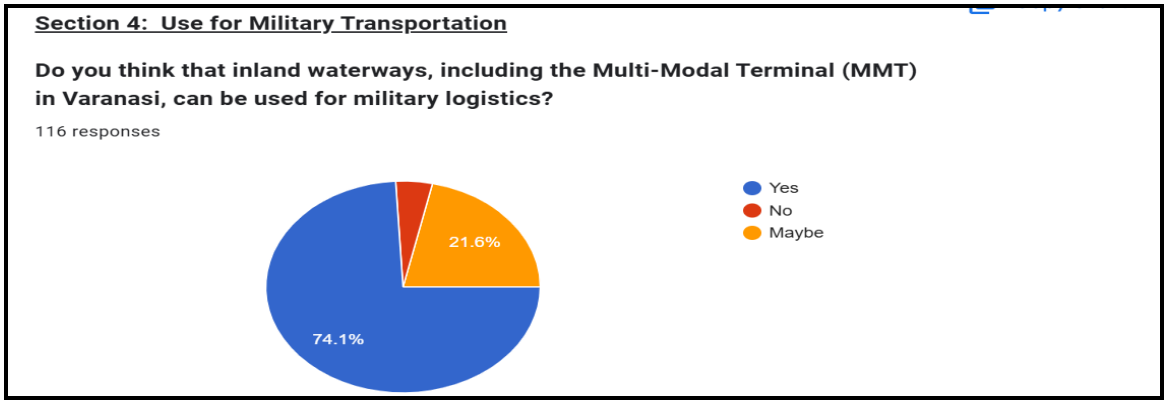
116 responses






5.6 Use for Military Transportation. Overwhelmingly the respondents believe that inland waterways, including the MMT in Varanasi, can be used for transportation of military logistics. The use of inland waterways for military purposes can reduce dependency on traditional transportation networks like roads and railways and enable decongestions of these networks as well enable alternative routes to key locations and cost effective operations. Majority of the respondents believe that civil military cooperation is a way forward for such national level projects. Major challenges for military logistics by inland waterways include limited infrastructure and security concerns. Pie charts given below:

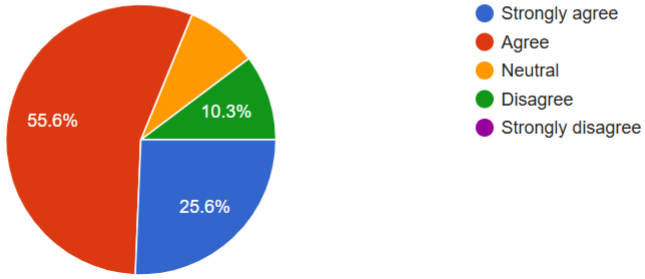
**Figure 5.5 Respondents Views on Use of Waterways for Military Logistics**



**Do you think the use of inland waterways for military purposes can reduce dependency on traditional transportation networks like roads and railways?**

Copy chart

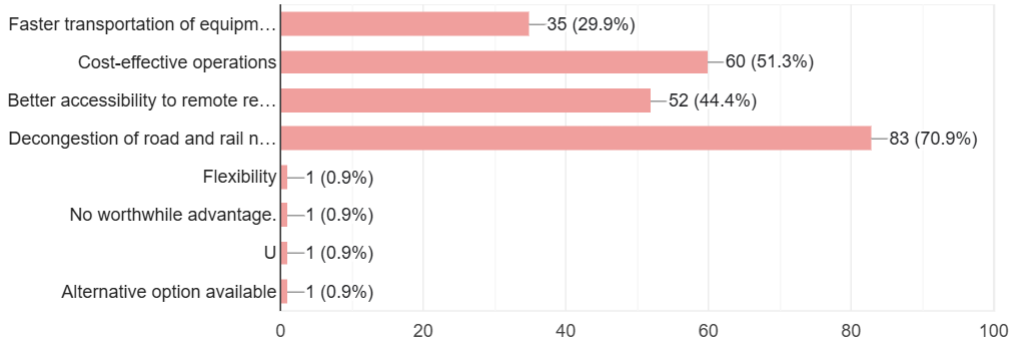
117 responses




**What are the potential advantages of using waterways for military logistics, in your opinion?** (Select all that apply)

Copy chart

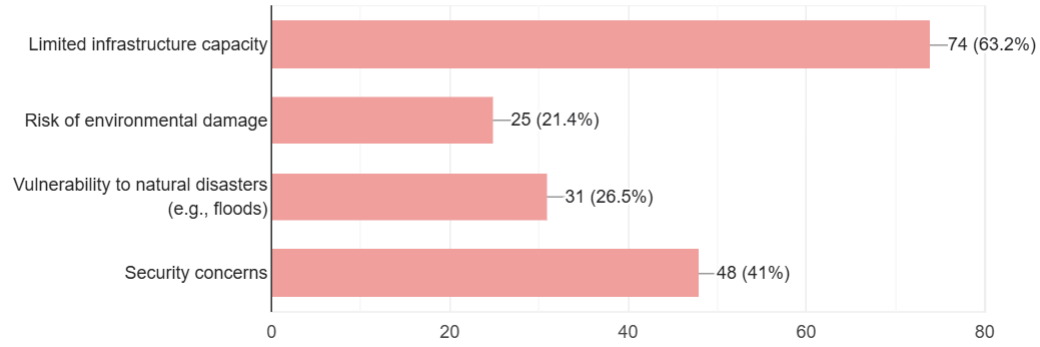
117 responses




**What are the potential challenges for military use of the Multi-Modal Terminal and waterways in Varanasi?** (Select all that apply)

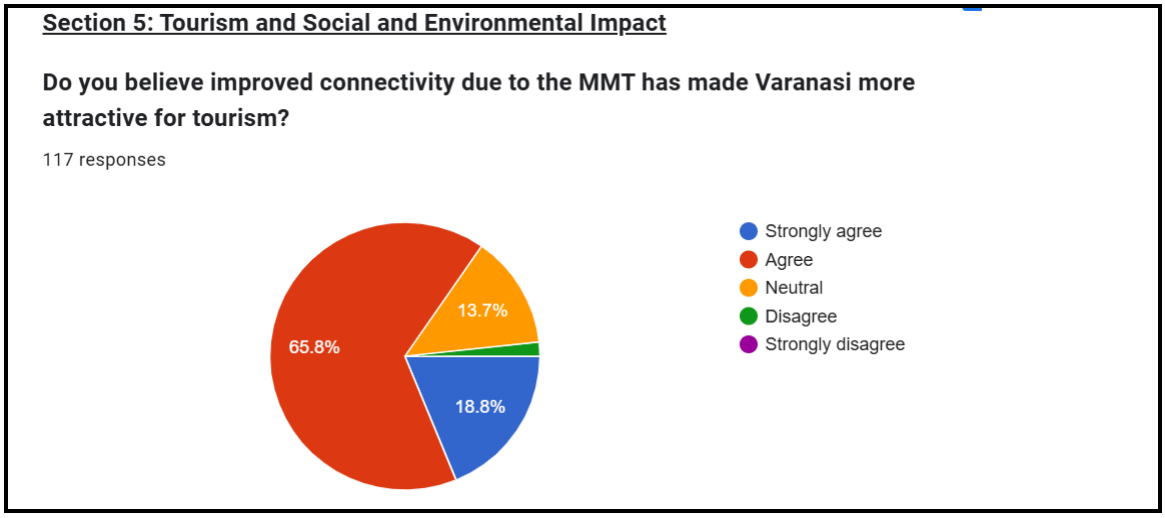
Copy chart

117 responses



5.7 Tourism and Environmental Impact. Majority of the respondents believe that improved connectivity due to the JMVP has made Varanasi more attractive for tourism. There has been a moderate increase in tourism in Varanasi with the commencement of the river cruises. Local communities have also been able to take advantage of these projects to improve their economic standing. With the operation of the MMT major environmental concerns include increase in water pollution and danger to the local bio diversity in the river, example the river dolphins, turtles etc. Respondents feel that the government has partially taken steps to mitigate these concerns and risks. Overall, respondents think that the MMT has had a positive economic impact on Varanasi. Pie charts given below corroborate the same:

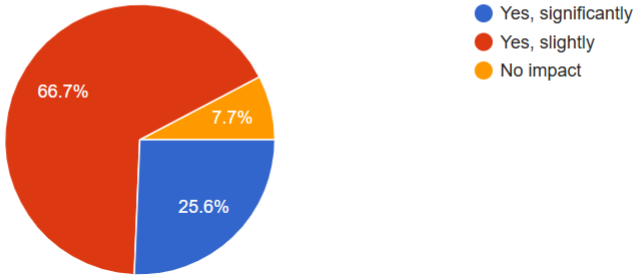
**Figure 5.6 Respondents Views on Tourism and Environmental Impact**



**Has the MMT brought more tourists to Varanasi, with commencement of the river cruise?**

Copy chart

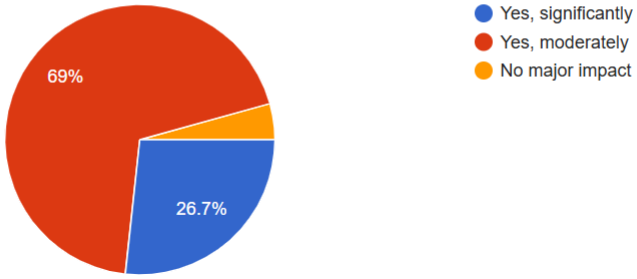
117 responses




**Do you think that local communities have benefitted from any ancillary infrastructure developments related to the MMT?**

Copy chart

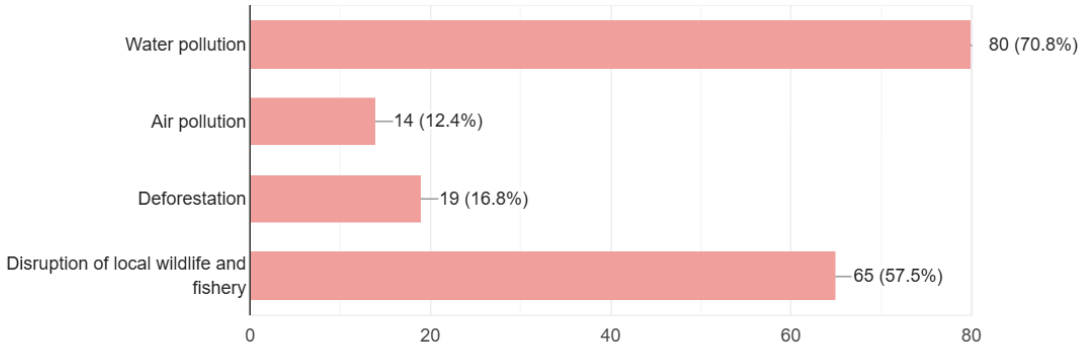
116 responses

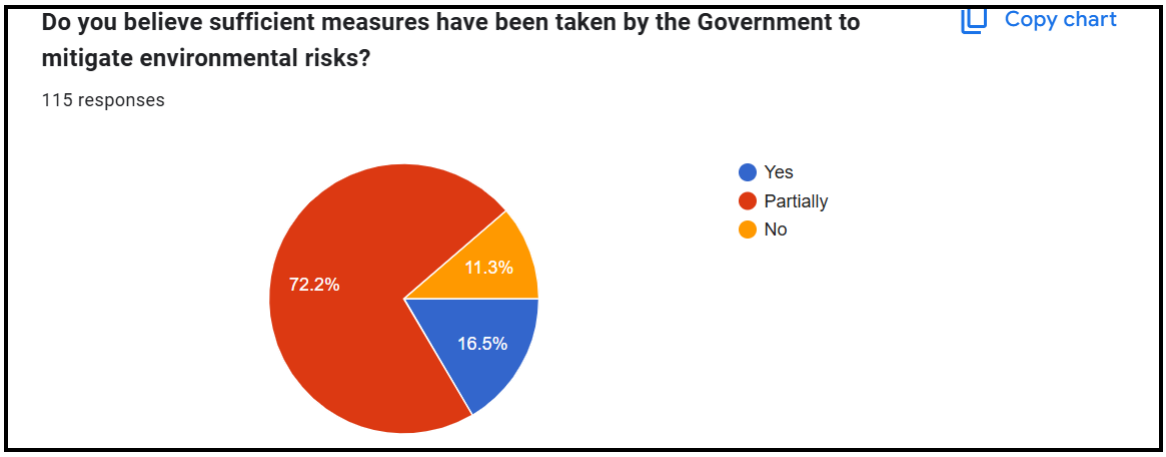


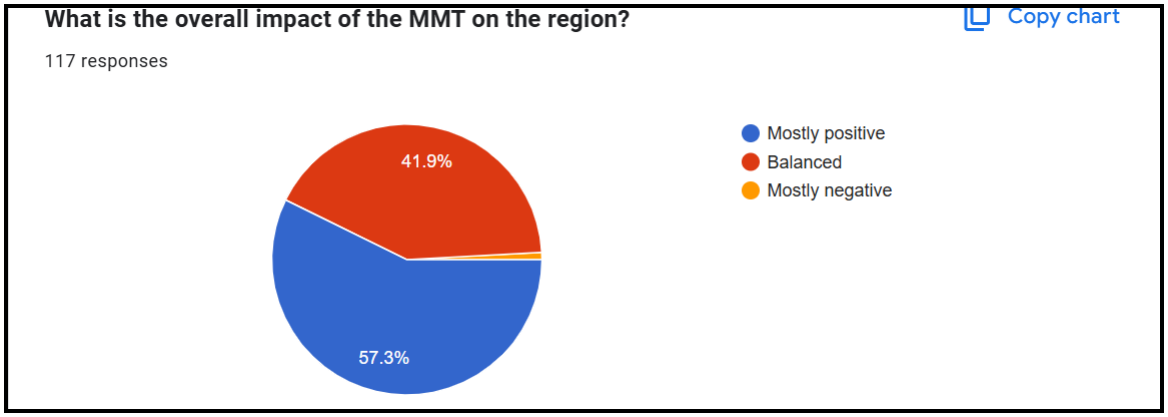

**What environmental issues have arisen from the terminal, if any?** (Select all that apply)

Copy chart

113 responses






5.8 Interaction with Officials at Inland Waterway Authority India, Noida. On 27th February 2025, I visited the Head Office of Inland Waterways Authority of India in Noida and interacted with the following officials:

(a) Shri Sunil Kumar Singh (ISS:1998), Vice Chairman.

(b) Shri Vinay Kumar Prajapati (IRSSE:2006), Member Traffic.

(c) Shri Ashutosh Gautam, Member Technical

(d) Col Harsh Vardhan, Secretary.

(e) Shri Arun Kumar Mishra, Chief Engineer and Project Manager, JMVP.

**Interaction with Shri V.K. Prajapati (IRSSE:2006), Member Traffic, IWAI**

**Summary of Interaction**

5.9 Discussion on JMVP and MMT**.** The Vice Chairman brought out the importance of the JMVP. It is an ambitious initiative aimed at developing National Waterway-1 (NW-1), spanning from Varanasi to Haldia. Implemented by the Inland Waterways Authority of India (IWAI) with technical and financial assistance from the World Bank, the project seeks to improve cargo transportation through inland waterways,

reducing logistics costs and dependence on road and rail networks. The project involves infrastructure development such as multi modal terminals, navigational aids, dredging activities and vessel procurement. By providing an alternative, cost effective and environmentally friendly mode of transport, JMVP aims to unlock the potential of India's inland waterways sector.

In the meeting, officials acknowledged that JMVP has made significant strides in recent years. Completion key infrastructure projects of multi modal terminals at Varanasi, Sahibganj and Haldia, along with intermodal connectivity with roads. Navigation infrastructure, including River Information Systems, night navigation facilities and channel marking, is gradually being deployed to ensure safer and more efficient transport. Additionally, certain stretches of NW-1 have been dredged to maintain minimum navigable depths, facilitating vessel movement. However, while the physical infrastructure has improved, the adoption of waterway transport by businesses and industries presently remains sluggish, necessitating further efforts in awareness building and policy support.

5.10 Progress of Multi-Modal Terminal at Varanasi. The Multi-Modal Terminal (MMT) at Varanasi is one of the flagship components of JMVP and was completed as part of the project's first phase. The terminal is spread over 73 acres and has been designed to handle both containerised and bulk cargo, linking waterways with rail and road networks for seamless multimodal logistics. The construction of the terminal was awarded to AFCONS Infrastructure Ltd. The construction began in 2016 and was completed in 2018. It was inaugurated by PM Modi on 12$^{th}$ November 2018. The

terminal jetty is 300 m long and 43 m wide. It has two mobile cranes with a lift capacity of 50 tons each. A main terminal building controls all operations. Since its inauguration, the terminal's utilisation remains lower than anticipated. Connectivity issues, lack of industrial uptake and limited vessel availability have hindered its full operational potential. Officials mentioned ongoing discussions with logistics firms, exporters and traders to promote the terminal's usage. Efforts are also underway to establish feeder routes and integrate rail-road connectivity more effectively to make inland water transport a viable option for businesses. Additionally 103 acres of land has been acquired for construction of phase 2 of the project. Work on a railway line connecting the terminal to Jeonathpur station is also due to commence shortly. Details of the MMT are attached as Appendix B.

5.11 Challenges Indentified. A detailed discussion with Director JMVP, Member Traffic and Secretary brought the following challenges being faced for optimum utilisation of inland waterways and the MMT:

(a) Budget Allocation. Director JMVP bought out the fact that budget allocation for inland waterways is relatively less as compared to roads and railways. This limited financial support affects infrastructure development, regular maintenance, dredging operations and vessel acquisition. Without sufficient funds, scaling up waterway transport to match road and rail networks becomes difficult.

(b) Navigability. One of the primary challenges faced in the operation of the MMT at Varanasi is maintaining year-round navigability on National Waterway-1. Given the fluctuating water levels of the Ganga, particularly during the dry season,

continuous dredging is required to sustain the depth necessary for barge movement. Regular dredging is required to maintain the minimum depth of 3 m needed for uninterrupted cargo movement. However, dredging is an expensive and time consuming process, requiring significant budget allocations and environmental clearances. During the monsoon season, water levels rise sharply, making navigation unsafe. These unpredictable conditions make inland water transport unreliable, forcing businesses to stick with more stable alternatives like roads and railways.

(c) Lack of Confidence in Waterway Transport. While the cost of transportation of goods is cheaper by waterways as compared to roads and railways, businesses remain hesitant to shift cargo movement to waterways due to uncertainty in delivery timelines, lack of infrastructure and limited industry engagement. Road and rail transport have well established logistics networks, making them faster and more predictable. Additionally, awareness about the benefits of inland water transport is still less and companies fear hidden operational costs and inefficiencies.

(d) Lack of Vessels for Transportation. Transportation by inland waterways is still in its infancy and the shortage of dedicated cargo vessels is another critical issue affecting the growth of inland water transport. IWAI has only a limited fleet of vessels which do not meet the requirements of large scale logistics operations. In addition due to the limited draught in most sections of NW-1, there is requirement of vessels with lower draught, which is not available in the IWAI's current inventory. Also, very few private players are investing in vessel manufacturing for

inland waterways, largely due to concerns over profitability, infrastructure gaps and uncertain trade volumes. Unlike rail and road transport, where fleet operators have well established business models, the inland waterway sector is still in its infancy in terms of commercial viability.

(e) Time Factor for Transportation of Goods. Transit time via inland waterways is often longer than road and rail transport. While highways offer faster point to point movement, water transport depends on water levels, vessel availability and terminal operations, which often leads to delays. Additionally, seasonal variations and unpredictable river conditions further increase transit uncertainty.

(f) Last Mile Connectivity Issues. A significant drawback of inland water transport is the lack of efficient last mile connectivity. Even if goods are transported via waterways, they still require road or rail connectivity to reach their final destination. Currently the multi modal terminals lack proper linkages to industrial zones, increasing logistics costs and transit times. Officials recognized that developing better intermodal integration with road and rail networks is crucial for increasing waterway adoption.

(g) High GST on Multi-Modal Transport. Member Traffic brought out that the Goods and Services Tax (GST) structure for multi modal transport remains unfavourable for inland waterways. While for waterways transport GST is 5%, however when it comes to multi modal either by road or rail transport, the GST slabs jump to 12-18% making it costlier for businesses. This tax disparity

discourages businesses from choosing waterway transport over traditional modes. Officials emphasized the need for GST rationalisation to make inland water transport a more attractive option.

(h) Lack of Cargo Volumes. Cargo volumes transported via waterways remain significantly lower than expected. Businesses continue to rely on road and rail, primarily due to established supply chains, better infrastructure and faster transit times. The absence of high volume goods like coal, cement and food grains in inland water transport limits commercial viability.

(j) Security Concerns. Security is also an issue in some stretches of NW-1. Cargo vessels are vulnerable to theft and logistical uncertainties, especially in remotely monitored river sections. Unlike highways and railways, which have regular security patrols and checkpoints, inland waterways currently lack dedicated enforcement mechanisms.

(k) Lack of Expertise with IWAI for Terminal Management. Another issue which emerged is that IWAI lacks specialised expertise in managing logistics hubs and terminals. Unlike the Indian Railways and National Highways Authority of India (NHAI), which have decades of experience in transport infrastructure management, IWAI is relatively new to handling large scale cargo operations. These result in inefficiencies in terminal management, cargo handling and logistics coordination, further impacting the project's effectiveness.

5.11 Visit to Varanasi. For field review and interaction with stakeholders a visit to Varanasi was undertaken from 4th to 6th March 2025. It involved meetings with Director, IWAI, Regional Office, Assistant Hydrographer, field visit to MMT, interaction at Bharat Hindu University (BHU), interaction with Antara Cruises and the Malah community.

5.12 Visit to IWAI Regional Office. On 4th March 2025 a visit to IWAI Regional Office was undertaken wherein a meeting was held with Shri RC Pandey, Director and other officials. He informed that in January this year the office at Varanasi has been upgraded from a Section Office to a Regional Office and they are in the process of establishing the new office in terms of staff and funds. Discussion revolved around the functioning and operation of the MMT since its inauguration in 2018. It was brought that currently the cargo transportation volumes are limited owing to the following issues:

(a) Lack of Available Draught. While the majority of NW-1 has adequate draught for plying of cargo vessels, the downstream stretch between Varanasi and Gazipur averages a depth of 2m which makes it unviable for vessel movement in the current water levels. The stretch cannot be dredged due to presence of hard rock on the bottom. The Director briefed of plans to carry out major excavation works to deepen this part of the channel.

(b) Silting. Maintaining adequate depth in the river channels is a major technical challenge for inland water transport. The Ganga River experiences seasonal fluctuations, leading to shallow stretches in certain areas. Regular dredging is required to maintain the minimum depth of 3m needed for uninterrupted cargo movement. Shri RC Pandey briefed that at present the

dredging operations are being undertaken based on a survey which is carried out every 15 days. The dredging contract has been awarded to M/s Dharti Dredging and Infrastructure Limited and they are operating two dredgers for the de-silting operations.

(c) Lack of Cargo Volumes. Cargo volumes transported via waterways remain significantly lower than expected. Businesses continue to rely on road and rail, primarily due to established supply chains, better infrastructure and faster transit times. Without sufficient trade volumes, private operators and logistics companies are hesitant to invest in inland water transport. The details of cargo transported to/from the MMT from its inauguration till January 2025, as provided by the IWAI, Regional Office is given as Appendix C. As per the details provided, a total of 14 vessel movements have taken place in the given period, between Kolkata and Varanasi, averaging two/three movements per year. All the vessels used were of the IWAI and the goods transported include urea, fertilizers, coal, silica sand, rice husk, cattle feed and FMCG. The total tonnage transported during the given period is 2,092 tons.

**Interaction with Shri RC Pandey, Director IWAI, Regional Office, Varanasi**

5.13 Visit to Multi Modal Terminal. Post the discussions at the IWAI Regional Office, a visit to the MMT, Ramnagar was under taken with two IWAI officials. The MMT is approximately 22 Km from Varanasi. At the site Shri Sashikant Upadhaya, Operations Manager gave a brief on the terminal layout and operations. The major components and the design of the jetty is given as Appendix D. The jetty is 300m x 42m and has two cranes of 50 tons capacity each. The terminal is spread over 73 acres and has all ancillary facilities in terms of lighting, port control, internal roads, security, storm drainage, passenger pontoons, gangways and sewage system for round the clock operations. The draught currently available is 27m which rises to 35m during the monsoons; this is adequate for operations of large vessels/barges. The last cargo

operation on the terminal was on 25 January 2025. An IWAI vessel, MV Homi Bhabha transported 91 MT of silica sand from Kolkata to Varanasi for M/s Mangalore Minerals Ltd. He informed that while the MMT has sufficient draught and capacity, the lack of draught in the waterway near Ghazipur is preventing large vessels to operate and thus currently the MMT is operating at a much lower capacity than envisioned. The alignment of the proposed railway line in the terminal and its linkage to Jeonathpur Railway Station was also shown. An IWAI survey vessel; MV Jhanvi is also berthed at the terminal and she carries out regular survey of the waterway from Chunar in the West to Ghazipur in the East every 15 days. This survey data is then provided to M/s Dharti Dredging and Infrastructure Limited which in turn carries out dredging operations in the required area. Shri Sashikant Upadhaya also showed the operation of the River Information system (RIS) which provides navigation data to vessels operating on the river; free of cost. In addition he briefed that as part of the 'Green Energy' initiative Cochin Shipyards has constructed a vessel for river tourism which operates on hydrogen, trails of which are underway. A hydrogen storage facility along with a pumping facility for filling up the vessel has been created in the terminal for the same.


**Project and Innaguration Plaque at MMT, Varanasi**

5.14 Employment Generation. As per the brief, during the construction of Phase 1 of the MMT, approximately 3,700 locals of Varanasi were directly employed by M/s AFCONS Infrastructure Ltd. In addition local transporters, taxi owners, catering businesses and hotels also derived benefits from the project. Currently the terminal has a staff of 26 people for management of its day to day operations and security. Accommodation for the staff is provided at the site itself.

**Site Visit to MMT, Varanasi**

5.15 Impact on Tourism. The terminal with its draught of 27 to 35 m and the 300 m jetty is also ideal for operation large tourist vessels. During the visit, MV Bengal Ganga, a luxury river cruise vessel of M/s Antara Cruises, Kolkata was berthed at the terminal. An interaction was carried with Mr Mohit Parmar, Operations Head onboard the vessel. Mr Mohit informed that the vessel has 20 luxury cabins and they offer 2/3 days trip on the Ganges from Varanasi to Sarnath and Prayagraj. However currently due to the low water levels in the river, they are not able to undertake the cruise. The vessel has been converted to a stationary Hotel for guests. From the terminal they offer boat rides on the Gangas for witnessing the evening Aarti at the Ghats. He lamented that the lack of

sufficient depth in the river makes it quite challenging to navigate and while a clientele is available however their inability to operate is resulting in loss of business. He too emphasized the urgent requirement of dredging and deeping of the channel to sustain their operations during the peak tourist season from October to March. Another issue he highlighted was that the local *Mallah* community at times prevents their cruise operations by blocking their path especially near the Ghats. The *Mallahs* feel that their livelihood will be lost if such big cruises operate on the Ganges. He informed that a number of talks with the *Mallah* community alongwith the District Administration have failed to resolve the issue at hand. He emphasised the need for government support and initial hand holding by both the Centre and State, if river tourism in Varanasi has to flourish as envisioned by PM Modi .

**Interaction with Mr Mohit Parmar, Antara Cruises**


**Hydrogen Powered Boat undergoing trails at MMT, Varanasi**

5.17 Visit to a Community Jetty. As part of the JMVP, a number of community jetties have been built on NW-1. The details are as Appendix E. Community jetties, also known as floating ports, have been strategically developed at docking points along the Ganges. These jetties cater to smaller boats, providing easy access to the river for a wide range of economic activities. There are eight such jetties in Varanasi and are being used by local traders, fishermen, boat operators and two of them have been developed at hubs for water sports. These jetties facilitate the movement of goods and reduce traffic congestion on roads. As per the IWAI official these jetties have proved to be a boon for the local traders as they now have an alternate dock away from the crowded Ghats for transporting their goods. The use of these jetties has reduced the transportation time and and also brought down their logistics cost. These words were echoed in a conversation with local traders during a visit to a community jetty located at Namo Ghat.

**Community Jetty at Namo Ghat, Varanasi**

5.18 Interaction with the local Mallah Community. The Mallah community, in Varanasi has been traditionally engaged in boating and they have played an important role in Varanasi's river based economy for generations. They expressed their happiness in with the development of Varanasi as a major tourist hub, the opening of the Kashi Vishwanath Corridor, other development projects and the Maha Kumbh has boosted their income. They believe that they are the custodians of river traditions, including rowing pilgrims to Ghats, conducting boat rituals etc. They expressed their concerns of large cruise vessels operating on the river, which poses a direct competition to their traditional economy. They also fear that corporate operators and large private players will soon dominate the river transport sector and they will be marginalised. In addition they narrated instances of their fishing nets being cut by these vessels resulting in losses. Hence they vehemently oppose any introduction of river cruises and operation of large

cruise vessels. They felt that dredging and deepening of the Ganges for large cargo vessels under JMVP has had a negative impact on the local fish populations, directly impacting their livelihood.

5.19 Interaction at Banaras Hindu University (BHU). To understand the local dynamics, an interaction on 05 March 2025 with Dr D.C. Rai, a Professor of Social Sciences at BHU was undertaken. He has been in Varanasi for the last 45 years. He eluded the fact that Varanasi today has emerged as a major tourist hub in the recent years and the locals have directly benefitted from it. The establishment of the community jetties is a boon for small business owners and local framers. The MMT par-se has not had any major economic impact on the livelihood of the locals other than during the two year construction phase, as the terminal is yet to operate to its full capacity. He felt that the Government will have to provide subsides/incentives to encourage the use of the waterways beyond the confines of Varanasi. Issues of last mile connectivity will also have to be addressed. He believed that local industries like Bharat Heavy Electricals Ltd (BHEL), Banaras Locomotive Works Factory, Northern Coal Fields Ltd can take advantage of the MMT and the waterways provided that large vessels can ply on it year round. There is requirement to indentify transportation grids from places like Kanpur which can connect to the MMT for further transport of goods by waterways towards Kolkata. On the issue of the Mallah community, he felt that there is a requirement to integrate them into the river tourism projects to ensure that there is minimum trust deficit and their livelihood is secured. Involvement of both the Centre and the State Governments is essential for the success of the JMVP.


**Interaction with Dr D.C. Rai, BHU**

5.20 Green Initiatives. The following 'Green Initiatives' have been incorporated on the Ganges in Varanasi:

(a) Floating CNG Plant. In 2021 GAIL entered into an agreement with Varanasi Nagar Nigam (VNN) for conversion of boats to the environment friendly fuel CNG. Till date, 735 such boats out of 890 registered with VNN have been converted to CNG under GAIL's CSR program at a cost of Rs 18 crore. The floating CNG Mother station at Namo Ghat, the first of its kind in the world, and has been operational since December 2021. The compression capacity of this station is around 15,000 kg/day of CNG which can fill approximately 1,000 – 1,500 boats per day. The new station at Ravidas Ghat is a CNG Mobile Refuelling Unit wherein CNG is filled in Tanks from Namo Ghat and transported by

water to Ravidas Ghat for fueling boats. It has a capacity of 4,000 kg/day and can cater to 300 to 400 boats per day. As CNG is more efficient fuel than diesel, it leads to significant savings for the boatmen. An estimated 35% more mileage is being attained by CNG powered boats viz a viz boats powered by diesel engines. The Varanasi project is part of the prestigious '*Pradhan Mantri Urja Ganga'* project and was inaugurated by PM Modi in 2018.

(b) Hydrogen Powered Vessel. A hydrogen powered vessel, manufactured by Cochin Shipyard Ltd at a cost of Rs 18 crore, is currently undergoing trails and is anchored at the MMT Varanasi. The vessel is 24 m long and can seat 50 people. The Ministry of Ports, Shipping and Waterways met 75 % of the cost of project. Post completion of trails, the vessel is scheduled to operate within Varansi and between Varanasi and Prayagraj.

# CHAPTER VI

## ANALYSIS AND RECOMMENDATIONS

6.1 Varanasi is one of the oldest continuously inhabited cities in the world. It is a cultural and spiritual hub and also a crucial economic and logistical centre. Its strategic location along the Ganga River makes it an important hub in India's inland water transport initiatives. Recognising its importance, the Government of India has positioned Varanasi as the central node in the Jal Marg Vikas Project, a project aimed at developing the National Waterway-1 from Haldia in West Bengal to Varanasi in Uttar Pradesh. Implemented by the Inland Waterways Authority of India with US $ 800 million in financial assistance from the World Bank, the project seeks to improve cargo transportation through inland waterways, reducing logistics costs and dependence on road and rail networks. The project involves infrastructure development such as multi modal terminals, navigational aids, dredging activities and vessel procurement. By providing an alternative, cost effective and environmentally friendly mode of transport, JMVP aims to unlock the potential of India's inland waterways sector. The Multi Modal Terminal in Varanasi serves as the project's linchpin, intending to link inland water transport with road and rail connectivity, thereby creating a seamless logistics ecosystem reducing dependency on road and rail transport while offering a cost effective alternative for cargo movement.

6.2 Progress of JMVP and MMT Varanasi. JMVP has made significant strides in recent years. Key infrastructure projects such as multi modal terminals at Varanasi, Sahibganj and Haldia, have been implemented to enhance cargo movement. Navigation

infrastructure, including River Information Systems, night navigation facilities and channel marking, is gradually being deployed to ensure safer and more efficient transport. Additionally, specific stretches of NW-1 are being regularly dredged to maintain minimum navigable depths, facilitating vessel movement. The project has also facilitated the development of community jetties to support local traders and small scale transport operators.

6.3 Cargo Movement and Utilisation of MMT, Varanasi. As part of the JMVP construction of the MMT at Varanasi, it started in 2016 and was completed in 2018. It is spread over an area of 73 acres. A 300 m x 43 m jetty equipped with two 50-ton capacity mobile cranes for advanced cargo handling, a terminal building, accommodation for staff, a passenger pontoon and other ancillary infrastructure is available for smooth and 24x7 operations. Currently, 26 people are employed at MMT. Adequate depth ranging from 27 to 35 m exists at the terminal to facilitate large vessel operations throughout the year. Designed to support both containerized and bulk cargo, it is envisioned as a key hub for multi modal transport integration, linking waterways, rail and road networks.

Despite its operationalisation in 2018, the MMT's capacity of 1.96 MT remains vastly underutilised. As per the data the IWAI Regional Office shared, Varanasi, 14 vessel movements between Kolkata and Varanasi occurred from November 2018 to January 2025, averaging two/three movements per year. All the vessels used were of IWAI and the goods transported included urea, fertilizers, coal, silica sand, rice husk, cattle feed and FMCG. The total tonnage transported during the given period is 2,092 tons. No private player has operated any vessel for cargo movement to date.

6.4 Economic Benefits of JMVP and MMT on Varanasi. The JMVP and the MMT in Varanasi represent transformative infrastructure initiatives that leverage India's vast riverine network for economic growth and sustainable development. The positive economic contributions are listed below:

(a) Reduction in Logistics Cost. One of the primary economic benefits of the JMVP and MMT is the potential to reduce logistics costs, thereby improving trade competitiveness. Waterway transport is inherently more cost effective than road and rail, with studies indicating that logistics costs via inland waterways can be 30-40% lower than road and rail transport. This cost advantage is particularly significant for businesses handling bulk goods, including coal, fertilizers, food grains and FMCG products. India's logistics cost accounts for around 13-14% of GDP, much higher than developed countries like the US, China and Europe, where the cost is about 8-10%. By optimising the NW-1 and taking benefit of the JMVP, businesses can experience substantial cost reductions, resulting in lower freight expenses and reduced dependency on fossil fuels, thus aligning with the SDG goals. The efficient transportation of goods through waterways will also decongest roads and railways, thereby reducing maintenance costs for the existing infrastructure. The Varanasi MMT is a crucial trade hub, enabling seamless cargo movement to eastern India, Bangladesh and even international markets. Local industries like BHEL, Banaras Locomotive Works Factory and Northern Coal Fields Ltd can use the MMT and the waterways. This has the potential to attract industrial investments, especially from logistics, warehousing and manufacturing sectors. The long term economic gains of enhanced connectivity between Uttar

Pradesh, Bihar, Jharkhand and West Bengal will further integrate these states into a more extensive trade network.

(b) Employment Generation and Local Economic Growth. The employment potential of the JMVP and MMT projects has been a significant economic driver along the NW-1. As per the data available, the construction phase of the MMT alone witnessed the employment of over 3,700 workers, providing a direct boost to local labour markets. Various ancillary industries, including transport, catering and hospitality industry benefited from the increased demand, leading to higher income levels for small businesses and service providers. Currently, 26 people are on the IWAI payroll for day to day operations and the security of the MMT. Moreover, as the MMT becomes fully operational, it is expected to create additional job opportunities in port management, logistics, cargo handling, security and administrative services. As part of JMVP, the development of eight community jetties in Varanasi has proved to be a boon for the local traders, small businesses, farmers and the Mallah community as they now have an alternate dock away from the crowded Ghats for transportation of their goods to the local markets. These jetties have reduced transportation time and brought down their logistics costs. The project fosters inclusive economic growth by integrating rural communities into the formal trade system. Taking a leaf from Bangladesh, where increased cargo movement on rivers has contributed to a 20% rise in employment in related sectors, a similar trend can be expected in Varanasi as JMVP expands, benefiting boat operators, logistics companies and industries in this region.

(c) Boost to Tourism and Hospitality Sector. Varanasi today is a globally recognised spiritual and cultural destination, attracting millions of domestic and international tourists annually. The JMVP and MMT projects can play a pivotal role in boosting the tourism industry in the region. The launch of luxury cruise services on the Ganga has the potential to generate substantial employment and revenue. The integration of river based tourism with the Kashi Vishwanath Corridor, Ganga Aarti and spiritual retreats can enhance the visitor experience, making Varanasi a high value tourism destination. Additionally, events such as Maha Kumbh Mela and Dev Deepawali can leverage inland water transport to manage tourist inflow efficiently, reducing road congestion and ensuring a seamless travel experience. Developing the Ghats as cultural hubs and heritage walkways along the Ganga could further enhance the city's attractiveness as a tourism hub. However, the lack of adequate depth in some riverine regions, incredibly close to Ghazipur on the NW-1, hampers the exploitation of the full potential of river tourism. The opposition of the local *Malah* community to the operation of these large vessel river cruises is also another challenge.

(d) Impact on Small Scale Entrepreneurs. The expansion of riverine tourism is expected to benefit Small and Medium enterprises (SMEs) involved in handicrafts, silk weaving and traditional music. Varanasi's famous Banarasi silk industry has seen a surge in demand through increased tourist footfall, boosting sales for local artisans and craftsmen. Riverfront bazaars along the Ghats are being developed to provide direct market access to artisans, reducing dependency on intermediaries and increasing profit margins.

(e) Environmental and Economic Sustainability. While there are economic gains due to the JMVP and the MMT, the environmental sustainability of these projects plays a crucial role in ensuring long term benefits. Waterways have a significantly lower carbon footprint compared to road and rail transport. A shift from truck based long distance logistics to waterways has the potential to reduce CO2 emissions by approximately 60-80% per ton/km transported, thus directly contributing to India's SDG goals. The freeze on dredging operations near the turtle sanctuary and incorporating modern technology like sonar ranging to protect the river dolphins during dredging operations is a positive step towards environmental sustainability. The introduction of CNG powered boats and floating CNG stations at Namo Ghat and Ravidas Ghat, as well as the trails of a hydrogen powered vessel for riverine tourism, are positive steps towards green transportation, further solidifying the project's sustainable development framework.

6.5 Challenges. Despite its promising economic contributions, the project faces certain challenges that need to be addressed for its optimum utilization and long term success:

(a) Budget Allocation. The budget allocation for inland waterways is over the years and even today is relatively less as compared to roads and railways. In 2024-25 the railway and roads budget was Rs 2.52 and Rs 3.01 lakh crore respectively while the IWT budget was Rs 1644 crore. For the current FY 2025-26, the railways and roadways budget is Rs 2.52 and Rs 2.87 lakh crore respectively while the IWT budget is pegged at Rs 1944 crore. This limited financial support

affects infrastructure development, regular maintenance, dredging operations and vessel acquisition. Without sufficient funds, scaling up waterway transportation to match road and rail networks becomes difficult.

(b) Navigability. One of the primary challenges facing the full fledged operation of the MMT at Varanasi is maintaining year round navigability on NW-1. Given the fluctuating water levels of the Ganga, particularly during the dry season, continuous dredging is required to sustain the depth necessary for barge movement. Dredging is essential for keeping the waterway navigable, but it is also an expensive and ongoing activity. The river's natural silt deposition pattern results in certain stretches becoming shallow especially near Ghazipur, requiring regular intervention to maintain the channel depth. To counteract this, the IWAI has undertaken several dredging projects along NW-1. However, the continuous need for sediment removal not only incurs high costs but also raises environmental concerns. The process of dredging can disturb aquatic habitats, affecting biodiversity and fish populations. The Gangetic dolphin, a critically endangered species, is particularly vulnerable to changes in the river's ecosystem caused by dredging activities.

(c) Last Mile Connectivity Issues. For the Varanasi MMT to function at its full potential, seamless last mile connectivity through road and rail networks is an essential prerequisite. Currently, while the terminal is linked to major highways such as NH-7, the lack of a dedicated rail link limits its efficiency in handling bulk cargo and containerized shipments. A significant challenge is the congestion on

existing roads leading to and from the terminal. Heavy truck traffic often causes delays, reducing the efficiency of cargo movement. This not only affects the terminal's output but also increases transportation costs for industries relying on it.

(d) Lack of Confidence in Waterway Transport. Today, most businesses and industries remain reluctant to adopt waterway transport due to a lack of confidence in its reliability, which is exacerbated by a lack of adequate depth for the operations of large sized vessels. IWT is inherently slower than railways, which may increase logistic costs. Many companies have long relied on road and rail transport, which are perceived as faster and more predictable. Additionally, inland waterways lack an established ecosystem of freight operators, logistics hubs and last mile connectivity, making businesses hesitant to shift to this mode.

(e) Lack of Vessels for Transportation. The shortage of dedicated cargo vessels is another critical issue affecting the growth of IWT. Currently, very few private players are investing in vessel manufacturing for inland waterways, mainly due to concerns over profitability, infrastructure gaps and uncertain trade volumes. Unlike rail and road transport, where fleet operators have well established business models, the inland waterway sector is still in its infancy regarding commercial viability. All cargo transport between Kolkata and MMT Varanasi from 2018 to January 2025 (14 trips in all) was undertaken by vessels of the IWAI. Until there is a sufficient volume of cargo movement, private players may remain hesitant to invest in vessels.

(f) Lack of Trade Volumes. A critical factor affecting the viability of JMVP is the current low trade volume that is being transported via waterways. Despite the availability of infrastructure like the MMTs at Varanasi, Sahibganj and Haldia, industries continue to prefer road and rail due to well established logistics networks and faster delivery times. This is a 'Catch 22' situation wherein, without sufficient trade volumes, private operators and logistics companies are hesitant to invest in inland water transport and without more logistics operators, businesses are reluctant to shift their supply chains to inland waterways.

(g) High GST on Multi Modal Transport. While traditionally, transportation of goods by waterways is a cheaper option (GST of 5%) than road and rail, when it comes to a multi modal transportation system, essential for last mile connectivity for inland waterway operations, the GST slab enhances to 12-18%, which in the overall context becomes unfavourable to the industry or businesses. This tax disparity discourages businesses from choosing waterway transport over traditional modes.

(h) Lack of expertise in IWAI for Terminal Management. Today, the IWAI lacks specialised expertise in managing logistics hubs and terminals. Unlike the Indian Railways and National Highways Authority of India (NHAI), which have decades of experience in transport infrastructure management, IWAI is relatively new to handling large scale cargo operations. This can result in inefficiencies in terminal management, cargo handling and logistics coordination, further impacting the project's effectiveness.

(j) Regulatory and Environmental Constraints. The development and operation of the MMT at Varanasi has to navigate a complex web of regulatory and environmental constraints. The Ganga is not just a commercial waterway but a lifeline for millions of people and a sacred river in Indian culture. Any large scale infrastructure project on the river must carefully balance economic progress with ecological preservation and socio cultural sensitivities. One of the primary regulatory challenges is adhering to environmental guidelines while ensuring the terminal remains commercially viable. The Namami Gange program, a Government of India initiative to clean and conserve the Ganga, imposes strict environmental regulations on industrial activities near the river. These regulations require that all infrastructure projects, including the MMT, implement stringent waste disposal and pollution control measures. Additionally, the terminal must comply with national and international environmental protection norms, which include provisions for minimising disruption to aquatic life, especially the endangered Gangetic dolphin. The current freeze on dredging in areas adjoining the turtle sanctuary near Varanasi is a direct outcome of these regulations.

(k) Security Concerns. Security is another significant issue in some stretches of NW-1. Slow moving cargo vessels are vulnerable to theft and logistical uncertainties, especially in remotely monitored river sections. Unlike highways and railways with regular security patrols and checkpoints, inland waterways lack dedicated enforcement mechanisms.

(l) Military Logistics. Using inland waterways for military logistics can reduce dependency on traditional transportation networks like roads and railways, enabling the decongestion of these networks. It can also enable alternative routes to key locations with cost effective operations. However, lack of infrastructure like ports and vessels along with issues of security currently restrict the use of inland waterways by the military.

(m) Mallah Community's Concerns. One of the most pressing social challenges arising from JMVP is the resistance from the Mallah community, which has traditionally been engaged in boating, fishing and small scale river transport. With the advent of large corporate vessels and luxury cruises, the Mallahs fear displacement and marginalisation in their own trade. Concerns include disruptions to their traditional boating economy, damage to fishing nets from large vessels and declining fish populations due to dredging operations. There have been instances of Mallahs obstructing cruise movements near the Ghats, protesting against what they perceive as a corporate takeover of their traditional livelihood. Many Mallah families live along the riverbanks and depend on the Ganges for their daily needs. Large scale riverfront development may lead to displacement or restrictions on where they can dock and operate. In addition increased traffic from large vessels poses a risk of accidents for smaller boats, leading to safety concerns. Members of the Mallah community have expressed frustration and demanded more representation in the decision making process.

6.6 Recommendations for Policy Interventions. Recommendations to address the challenges in JMVP and to make MMT Varanasi economically viable are as enumerated below:

(a) Increase Budget Allocation for Inland Waterways. One of the most urgent issues is the disproportionately low budget allocation for inland waterways compared to road and rail networks. While highways and railways receive multi lakh crore investments annually, inland waterways receive only a fraction of that amount. This limits critical activities such as dredging, infrastructure development, vessel procurement, navigation facilities and security improvements. To address this, the Government needs increase budgetary allocations for inland water transport in a phased manner, aligning them with national logistics and trade needs. Introducing dedicated funding schemes and financial incentives will encourage private sector participation in the development of inland water transport. Additionally, we should explore international funding and grants from institutions like Asian Development Bank (ADB) and Japan International Cooperation Agency (JICA) to support infrastructure enhancement and operational efficiency.

(b) Implement a Long Term Dredging Strategy. Dredging is essential for maintaining navigability, but it remains one of the most technically and financially challenging aspects of inland water transport. Many stretches of NW-1 suffer from seasonal depth variations, which require continuous dredging operations to keep routes open for cargo movement. However, dredging is an expensive process that demands regular budget allocations and environmental clearances. One potential

solution to reduce the dependency on dredging is to adopt sustainable sediment management techniques. These could include bandalling, a method where bamboo poles and nets are used to guide the river's flow, preventing excessive siltation in critical navigation areas along the banks. Additionally, river works, such as building guide bunds can help maintain a stable channel without frequent dredging. Hydrographic surveys and advanced sediment tracking technologies can also aid in predicting silt deposition trends, allowing for targeted dredging efforts rather than widespread sediment removal. Another viable approach is the implementation of Public Private Partnerships (PPP) in dredging operations. Currently, dredging is predominantly handled by IWAI, but involving private players could introduce cost sharing mechanisms and improve efficiency through competitive contracting. Governments in countries with well developed inland waterways, such as Germany and Netherlands, have successfully leveraged private participation in waterway maintenance, thus reducing the burden on state resources.

Dynamic water level management through barrage control is another potential long term solution. By strategically placing barrages and locks along the waterway, it is possible to regulate water levels, thereby reducing the frequency of dredging. While this requires significant capital investment, it offers a more sustainable solution in the long run.

The economic feasibility of continuous dredging is another concern. While inland waterways are promoted as a cost effective mode of transport, the high maintenance costs associated with dredging can offset these advantages. Thus, policymakers

need to balance the economic benefits of inland water transport with the recurring costs of maintaining navigability. Establishing a dedicated dredging fund, supported by toll fees from commercial users, could help sustain operations without overburdening government finances.

(c) Build Industry Confidence in Waterway Transport. The findings indicate that one of the major hurdles in JMVP's success is the lack of confidence among industries in shifting their cargo transportation from road and rail to waterways. While transportation cost by waterways is the least as compared to any other mode of transport, businesses rightly perceive inland water transport as slow, unreliable and inefficient, leading them to continue using traditional transport modes which are relatively more expensive but reliable. To overcome this challenge, the Government needs to conduct awareness campaigns, organise stakeholder consultations and provide industry specific data showcasing the benefits of waterway transport, such as lower fuel costs, reduced carbon footprint and bulk cargo handling efficiency. Successful pilot projects demonstrating cost savings and efficiency gains will also play a crucial role in building confidence among businesses. Additionally, offering financial incentives like freight discounts, lower port fees and tax benefits for early adopters will help encourage a gradual shift towards waterways. Public Sector Units (PSUs) can be encouraged to use IWT for transportation of raw material or finished goods which will generate confidence in this mode of transportation and attract private players too. Under the recently launched '*Jalvahak Scheme*' businesses transporting goods over distances exceeding 300 km via waterways will receive upto 35% reimbursement on the

overall operating costs. This scheme was launched on 15th December 2024 and is designed to encourage businesses to use IWT for transportation of goods on the National Waterways. Commencement of scheduled services on NW-1 will also instill confidence in the industry and businesses.

(d) Addressing the Shortage of Cargo Vessels. The inland water transport sector in India is severely constrained by a shortage of dedicated cargo vessels. IWAI has only seven cargo vessels as on date which is quite less for the projected cargo volumes on the NW-1. Unlike road and rail transport, where thousands of trucks and railway wagons are available, there are very few private vessel operators in the inland shipping sector. To address this, the government should offer financial support and subsidies to private players for vessel manufacturing, leasing and acquisition. Encouraging joint ventures between Indian and international shipbuilding companies can accelerate the production of modern, efficient river vessels. Additionally, easing regulatory barriers for vessel registration, financing and operations will attract more investment in the sector. Large logistics firms should also be incentivised to invest in dedicated cargo vessels through tax benefits and concessional financing options.

(e) Increase Trade Volumes through Targeted Cargo Engagement. Despite significant investments in infrastructure, cargo movement through waterways remains far below potential. Businesses continue to rely on road and rail due to better established supply chains and faster delivery times. To boost trade volumes, authorities must identify and engage industries that can benefit most from inland

water transport, such as coal, cement, fertilizers, food grains and construction materials. Offering subsidised tariffs, assured cargo handling efficiency and dedicated storage facilities will incentivise these industries to shift their transportation modes. Additionally, contractual agreements with major industrial players can help secure a steady flow of cargo through waterways, ensuring financial sustainability. Identifying and securing high potential cargo categories (cargo traps) will be critical to increasing trade volumes. Kolkata and Kanpur are two major cargo hubs which can be serviced by the MMT at Varanasi.

(f) Last Mile Connectivity Concerns For the Varanasi MMT to function at its full potential, seamless last mile connectivity through road and rail networks is an essential prerequisite. Currently, while the terminal is linked to major highways such as NH-7, the lack of a dedicated rail link limits its efficiency in handling bulk cargo and containerised shipments. The most effective solution to this issue is fast tracking the completion of the Jeonathpur rail connectivity project. A dedicated rail siding connecting the terminal to the Eastern Dedicated Freight Corridor (EDFC) would allow for seamless transfer of goods between waterway and rail, significantly improving logistical efficiency. This would particularly benefit bulk cargo transport, which is less suited for road haulage due to high costs and volume constraints. Additionally, expanding Roll On –Roll Off (Ro-Ro) services, where trucks can be transported on barges to reduce road congestion, will prove to be a game changer for last mile connectivity.

(g) Establishment of Freight Villages. A freight village is a designated area where facilities for various modes of transportation, distribution of goods and other logistics are available in a synchronised manner on a large scale. The main function of freight villages is management and utilisation of various modes of transport, synergising them and decongesting the existing mode of transportation. Freight villages are basically cargo aggregators which offer various logistic choices to a shipper/ cargo owner. Delivery and coordination of various freight related activities under one roof ensures ease of doing business and makes it possible to realise high cargo capacity due to which economic efficiency and activity of the enterprises on site can be improved. The Ministry of Shipping has approved the development of a Rs 156 crore Freight Village in Varanasi adjoining the MMT in Varanasi. The freight village will be developed by the IWAI. It will serve as a cargo hub and a centre for aggregation and value addition. It will also provide support to stimulate development of a professional logistics industry in Varanasi. The Varanasi freight village is proposed to be developed over a land area of about 100 acres, which will be acquired in two phases ie 70 acres in first phase and 30 acres in second phase at a total estimated cost of Rs 120 crores. The IWAI will own the land of the freight village, but it is proposed that a part of it will be leased to logistics companies and waterways related manufacturing and trading companies at prices to be fixed as per prevailing market conditions.

(g) Reduce GST on Multi Modal Transport. While transportation of goods by waterways is inherently less expensive, multi modal transport is an essential cog for waterways to improve the last mile connectivity. Currently, multi modal

transport involving inland waterways is subject to higher GST slabs, making it less competitive than road and rail transport. This tax disparity discourages businesses from adopting water transport as part of their logistics strategy. Rationalising GST rates for multi modal transport, especially for cargo moved via inland waterways, will make this mode of transportation more attractive. Introducing tax exemptions or lower GST rates for cargo transported through inland waterways can further incentivise businesses. The Jalvahak Scheme which gives 35% rebate on the operating cost of transportation of goods by IWT is a welcome step in this direction.

(h) Port Management Expertise within IWAI. Sea ports have been operational for a long time and port management expertise exists both with the Government and private players in India. Indian Railways and National Highways Authority of India (NHAI), also have extensive expertise in logistics management. However river ports and MMTs are just about coming up along the National Waterways and IWAI lacks both experience and expertise in managing large scale cargo operations and logistics hubs. As a start specialised training programs and capacity building initiatives should be introduced for IWAI officials. Collaborating with global port management firms and logistics companies can help bring international best practices to India's inland transport sector. IWAI has signed a MoU with Inland & Coastal Shipping Ltd (ICSL) for management of the MMTs. In addition outsourcing terminal operations to experienced private logistics operators through a Public-Private Partnership (PPP) model will further improve efficiency and also save the scarce resources of IWAI.

(j) Military Logistics. Inland waterways and IWT can play a significant role in transportation of military logistics especially during the time of general mobilisation. Military units in the hinterland which need to move to the front lines can use this mode of transportation in addition to road and railways to achieve faster mobilisation timelines. This will also enable the decongestion of critical road and rail space. In addition the transportation of logistics both during peace and war can be explored through the inland waterways. Infrastructure in terms of jetties, cargo handling equipment and vessels will have to be built up to cater for such operations. There is need for greater synergy between the civil bureaucracy and the military to enable the optimum usage of this national resource. As trade movement increases along the waterways, security will also be required to be enhanced on the vulnerable stretches. Enhanced river patrolling by security forces, communication infrastructure and check points will need to be established to ensure safe passage of vessels.

(k) Addressing the Concerns of the Mallah Community. The Mallah community, primarily engaged in fishing and ferrying along the Ghats of Varanasi, faces socio economic risks due to the JMVP. The modernisation of inland water transport, increased dredging and changes in river traffic patterns threaten their traditional occupations. To ensure inclusive development, it is crucial to introduce targeted interventions that provide alternative livelihoods, compensate for potential losses and integrate the community into the emerging river based economy.

One of the most effective ways to support the Mallah community is by integrating them into the formalised ferry and tourism sector. The JMVP will significantly expand passenger ferry services, creating a demand for skilled boat operators, navigators and service providers. By providing structured training programs, the Government can equip the community members with the necessary skills to operate modern vessels.

Cooperative ownership models can also be looked into wherein establishing community led cooperatives would allow them to own, operate and manage tourism and ferry services collectively, ensuring fair profit distribution and economic sustainability. The government can facilitate this process by offering low interest loans and technical support. These cooperatives could operate heritage Ghat boat rides, water sports services and pilgrimage tourism packages, capitalising on Varanasi's status as a major spiritual and cultural destination. Additionally private investors and tourism companies can be encouraged to partner with these cooperatives, ensuring that local expertise is valued, retained and monetised within the formal tourism industry. Beyond financial integration, it is equally important to empower the Mallah community and involve them as an important stakeholder in the development of river tourism in Varanasi. This will prevent their marginalisation while creating a sustainable and community driven river economy. Ensuring the participation and economic security of the Mallah community will not only preserve their cultural heritage but also enhance the overall success of the JMVP, making it a model for socially responsible infrastructure development in India.

(l) Addressing Environmental Concerns. The JMVP project involves dredging, increased vessel traffic, infrastructure development and changes in river hydrology, all of which can disrupt the ecological balance of the Ganga River which supports rich biodiversity, including endangered species like the Gangetic dolphin, gharial and the river turtle. Dredging is a key component of JMVP, ensuring minimum navigable depths for cargo and passenger vessels. However continuous dredging can disturb riverbed ecosystems, affecting fish spawning grounds and aquatic vegetation. Dredging also leads to bank erosion and habitat loss. There is a need for developing protected aquatic zones where dredging is restricted, ensuring biodiversity conservation. With increased commercial and passenger traffic on the river, there is a higher risk of water pollution from oil spills, sewage discharge etc. Strict regulatory mechanisms need to be in place to ensure waste management and waste treatment facilities at ports. In addition green shipping practices, including the use of electric or hybrid powered boats must be encouraged. To detect pollution levels, real time water quality monitoring systems along the waterway need to be installed. JMVP needs to balance economic development with environmental responsibility. A strong regulatory framework and stakeholder collaboration will ensure that river ecosystems are preserved while benefiting from modernized infrastructure and increased connectivity.

6.7 Directions for Future Research. The JMVP for development of the NW-1 is still an ongoing project with several phases yet to be implemented. Future research could look at impact of increased budget allocations for inland waterways and evaluate industry adoption challenges. Research could also investigate vessel shortages, trade volume

optimisation and the impact of targeted cargo engagement on industry participation. The effectiveness of tax incentives like GST rationalization and the Jalvahak Scheme in promoting multi modal transport can be studied in parallel with best practices in port management and outsourcing strategies. Military logistics applications of inland waterways and security concerns need further exploration, as do the socio economic effects on the Mallah community, focusing on livelihood transitions and cooperative ownership models. Environmental research may examine the effects of dredging, green shipping technologies and biodiversity conservation policies. Comparative analysis of successful global inland waterway models, legal and regulatory frameworks and policy innovations could provide insights for optimising India's inland transport network.

6.8 Conclusion. The JMVP and the development of the MMT in Varanasi holds immense potential to revolutionise India's inland water transport system. While there have been positive economic outcomes of the project in Varanasi; the current operational deficiencies, industry reluctance, navigability issues and socio economic conflicts need to be addressed through Government policy interventions to ensure its success. By implementing targeted policy reforms, infrastructure upgrades, financial incentives and community integration strategies, JMVP and the MMT can become catalysts for economic growth, sustainable logistics and inclusive development in the region. Proper execution of the given recommendations will enable Varanasi to emerge as a key multi modal logistics hub, driving long term prosperity for businesses, industries and local communities alike while preserving the cultural and ecological heritage of the Ganga.

## BIBLOGRAPHY


Ball, P. (2017). *The Water Kingdom: A Secret History of China.*

Bhagwati, A. (2018). *Inland waterways transportation in India: Understanding and meeting shipper's service requirements.*

Brahma, G. D. (2006). *The Evolution of Perspective Of Inland Water Transport In India.*

Britannica. (n.d.). Retrieved from https://www.britannica.com

Chaturvedi, M. C. (2011). *Advances in Development and Management.*

Chawla, V. (2016). *India's Emerging Quest to Develop Inland Waterways.*

CUTS International. (2017). *Expanding Tradable Benefits of Inland Waterways.*

Dharmadhikary, S., & Sandbhor, J. (2017). *National Inland Waterways in India: A Strategic Status Report.*

EQMS India Pvt. Ltd. (2019). *Study On Effect Of Navigational Activities On Dolphin In The National Waterway-1*.

Gokhale Committee Report. (1959). *Report on the Inland Water Transport.*

Government of India, Ministry of Finance. (1971). *Economic Information.*

Government of India, Ministry of Shipping. (n.d.). *Inland Water Transport.* Retrieved from https://shipmin.gov.in

Government of India, Planning Commission. (2014). *India transport report: Moving India to 2032.*

Government of India, Planning Commission Committee on Transport Policy and Coordination. (1985). *Final Report.*

Gupta, A., Anand, N., & Bansal, A. K. (2017). *A Journey through Development Of Inland Waterways In India.*

Inland Waterways Authority of India (IWAI). (2007). *Detailed Project Report on Intermodal Terminal at Varanasi.*

Inland Waterways Authority of India (IWAI). (2016). *National Waterways Act.* Government of India.

Inland Waterways Authority of India (IWAI). (2017). *Jal Marg Vikas Project - FAQs.* Retrieved from http://iwai.nic.in/showfile.php?lid=864

Inland Waterways Authority of India (IWAI). (2022-2023). *Annual Report.*

Inland Waterways Authority of India (IWAI). (n.d.). *National Waterways-1*. Retrieved from https://www.iwai.nic.in

Joy, K. J., & Janakarajan, S. (2018). *India's Water Futures: Emergent Ideas and Pathways.*

KPMG. (2014). *Report On Water Transportation In India.*

Mallet, V. (2017). *River of Life, River of Death: The Ganges and India's Future*.

Ministry of Ports, Shipping and Waterways, Government of India. (2020). *Jal Marg Vikas Project: Policy and Implementation Report.*

Ministry of Shipping, Government of India. (n.d.). *Inland Water Transport.* Retrieved from https://shipmin.gov.in

Mishra, A. (2021). *Possibility Of Inland Waterways For Growth Of Uttar Pradesh.*

Mishra, A., Saxena, A., & Khanapuri, V. B. (2021). *Evaluating Development Opportunities for Inland Water Transport In India*.

Mittal, J. (2013). *Nationalization of Inland Water Navigation.*

Press Information Bureau, Government of India. (2018). *Cabinet Approves Implementation of JMVP*. Retrieved from https://pib.gov.in

Rangaraj, N., & Raghuram, G. (2007). *Viability of Inland Water Transport In India. INRM Policy Brief, ADB, New Delhi.*

Report of Inland Water Transport Committee. (1980).

Sen, S. (2019). *Ganges: The Many Pasts of An Indian River*.

Sharma, N. (2017). *River System Analysis and Management.*

Singh, S., & Barpete, K. (n.d.). *Navigating The Ganges: Exploring the Role of Inland Water Transport In Enhancing Accessibility, Affordability and Acceptability In Varanasi.*

Sriraman, S. (2010). *Long-Term Perspectives on Inland Water Transport In India. RITES Journal.*

Tata Consultancy Services (TCS). (2004). *Report on the Development of Coastal Shipping.*

The Great Trade Routes. (2012). *A History of Cargoes and Commerce Over Land and Sea.*

Wiegmans, B., & Konings, R. (2016). *Inland Waterway Transport: Challenges and Prospects.*

World Bank. (2017). *Developing India's First Modern Inland Waterway. The World Bank Brief.* Retrieved from http://www.worldbank.org/en/country/india/brief/developing-india-first-modern-inland-waterway

World Bank. (n.d.). *Jal Marg Vikas Project.* Retrieved from https://www.worldbank.org

# Questionnaire

## Economic Impact of Jal Marg VikasProject (National Waterway-1), in Varanasi, Uttar Pradesh

**DISCLAIMER** - The information collected in this survey will be solely used for academic research purposes to explore the economic impact of the **Jal Marg Vikas Project (National Waterway-1)** and the **Multi Modal Terminal at Varanasi**. Your responses will remain confidential and will not be disclosed to any third party. Participation is entirely voluntaryand you can choose to skip any question, if required. Your valuable inputs will aid my research.

* Indicates required question

**Section-1 General Information**

1. Your Name*

2. Your Occupation*

3. Educational Qualification*

*Mark only one oval.*

High School
Graduate
Postgraduate
Doctorate
Other:

4. Age Group*

*Mark only one oval.*

15- 20 years
21-30 years
31-40 years
41-50 years
51+ years

**Section 2: Awareness and General Perception**

5. **Are you aware of the National Waterways Development Projects initiated by the Government of India?**

*Mark only one oval.*

Yes, I am fully aware
Yes, but I know only a little
No, I am not aware

6. **Do you believe inland waterways can significantly contribute to improving India's transportation network?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

7. **Do you see the Multi-Modal Terminal (MMT) in Varanasi as part of a larger initiative for regional and national development?**
*Mark only one oval.*
Yes
No
Not sure

8. **In your opinion, does the MMT make Varanasi more important as a trade and logistics hub?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

**Section 3: Economic Impact**

9. **General Economic Perception - Do you believe the Multi-Modal Terminal (MMT) in Varanasi has enhanced the overall economic profile of the region?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

10. **Has the MMT attracted new industries or businesses to Varanasi and the surrounding region?**
*Mark only one oval.*
Yes, significantly
Yes, moderately
No noticeable change
Not sure

11. **Do you think the development of the MMT will encourage investments in related infrastructure (e.g., roads, warehouses)?**
*Mark only one oval.*
Yes, significantly
Yes, moderately
No noticeable change

12. **In your opinion, which sectors have bene**fi**ted the most economically from the MMT?** (*Select all that apply*)
Trade and logistics
Manufacturing
Retail and small businesses
Agriculture and agribusiness
Tourism
Other:

13. **Has the MMT in**fl**uenced the ease of transporting goods for local businesses?**
*Mark only one oval.*
Greatly improved
Slightly improved
No noticeable impact
Made transportation more challenging

14. **What speci**fi**c bene**fi**ts do you think that MMT provides to businesses in the region?** (*Select all that apply*)
Reduced transportation costs
Increased market access
Faster delivery times
Lower logistical risks

**Section 4: Employment and Skill Development**

15. **What do you think has been the overall impact of the MMT on employment opportunities in the region?**
*Mark only one oval.*
Significant increase in job opportunities
Moderate increase
No noticeable change
Decrease in opportunities

16. **In which sectors do you think that most jobs have been created or impacted by the MMT?** (*Select all that apply*)
Logistics and supply chain management
Transportation and shipping services
Retail and commerce

Warehousing and storage

17. **Do you think the MMT has encouraged skill development or training programs in the region?**

*Mark only one oval.*

Yes, significantly
Yes, moderately
No noticeable impact
Not sure

**Section 5: Impact Investments and Trade**

18. **Do you think that real estate prices or investments in have increased in the region a since the MMT began operations in 2016?**

*Mark only one oval.*

Increased significantly
Increased moderately
No change

19. **What kind of real estate developments have been in**fl**uenced by the MMT in the region?** (*Select all that apply*)

Residential housing projects
Commercial buildings
Industrial parks
Warehousing and logistics centers
Other:

20. **Do you believe the MMT has made Varanasi more attractive for external investors?**

*Mark only one oval.*

Strongly agree
Agree
Neutral
Disagree
Strongly disagree

21. **Do you think that MMT affected regional trade patterns?**

*Mark only one oval.*

Increased significantly
Increased moderately
No noticeable impact
Negatively impacted

22. **Do you think improved connectivity via the MMT has made Varanasi a stronger regional trade hub?**
*Mark only one oval.*
Yes, significantly
Yes, moderately
No noticeable change

23. **In your opinion what types of goods or services have seen the most growth due to the MMT's connectivity?**
*Mark only one oval.*
Agricultural products
Handicrafts and traditional goods
Manufacturing goods
Construction materials
Other:

**Section 6: Community-Level Economic Impact**

24. **What type of economic changes do you think has MMT contributed to?** (*Select all that apply*)
Increase in trade and logistics businesses
Boost to local industries
Growth in retail and small businesses
Rise in employment opportunities
Other:

25. **Do you think that transportation costs for goods in the region has decreased due to the terminal?**
*Mark only one oval.*
Yes, significantly reduced
Yes, moderately reduced
No significant change

26. **Do you believe the MMT has contributed to attracting new businesses or industries to Varanasi?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

**Section 7: Use for Military Transportation**

27. **Do you think that inland waterways, including the Multi-Modal Terminal (MMT) in Varanasi, can be used for military logistics?**
*Mark only one oval.*
Yes
No
Maybe

28. **Do you think the use of inland waterways for military purposes can reduce dependency on traditional transportation networks like roads and railways?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

29. **What are the potential advantages of using waterways for military logistics, in your opinion?** (*Select all that apply*)
Faster transportation of equipment
Cost effective operations
Better accessibility to remote regions
Decongestion of road and rail networks
Other:

30. **How do you perceive the strategic importance of Varanasi's location for military logistics via waterways?**
*Mark only one oval.*
Highly strategic
Moderately strategic
Not strategic

31. **Do you think collaboration between the military and civilian authorities in managing the MMT is beneficial?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

32. **What are the potential challenges for military use of the Multi-Modal Terminal and waterways in Varanasi?** (*Select all that apply*)
Limited infrastructure capacity
Risk of environmental damage
Vulnerability to natural disasters (e.g., floods)
Security concerns

**Section 8: Tourism and Social and Environmental Impact**

33. **Do you believe improved connectivity due to the MMT has made Varanasi more attractive for tourism?**
*Mark only one oval.*
Strongly agree
Agree
Neutral
Disagree
Strongly disagree

34. **Has the MMT brought more tourists to Varanasi, with commencement of theriver cruise?**
*Mark only one oval.*
Yes, significantly
Yes, slightly
No impact

35. **What is the overall impact of the MMT on the region?**
*Mark only one oval.*
Mostly positive
Balanced
Mostly negative

36. **Do you think that local communities have bene**fi**tted from any ancillary infrastructure developments related to the MMT?**
*Mark only one oval.*
Yes, significantly
Yes, moderately
No major impact

37. **What environmental issues have arisen from the terminal, if any?** (*Select all that apply*)
Water pollution
Air pollution
Deforestation
Disruption of local wildlife and fishery

38. **Do you believe sufficient measures have been taken by the Government to mitigate environmental risks?**

*Mark only one oval.*

Yes
Partially
No

https://docs.google.com/forms/d/197kLVSbjp26d-CKJZoZorSMZRFX5QnE2ly0C5cYXBek/edit

**Appendix B**

# Multi- Modal IWT Terminal at Varanasi, Uttar Pradesh

## Major Components of MMT Varanasi

• Berthing Structure: 300m length x 42m (35+7) Width

• Bank Protection Works: 370m

• Substation & Workers Amenity Building: 400 Sqm + 30 Sqm

• Mobile Harbour Crane: 2 Nos. of LHM 180 Crane of LIEBHERR make (50 Ton capacity at 17-18m outreach)

• Passenger Pontoon: 20m x 10m

• Gangway: l.2m wide

• Internal Road: Two lane flexible pavement of 365m length

• Water Supply System: Tube well discharge 15 cum/hour with depth of bore 120m

• Strom Water Drainage System: Designed for Rainfall intensity 80 mm/hour

• Sewerage System: Pipeline system connected to Septic Tank (16.32 M3)

• Electrical Equipment

• High Mast lighting: 6 nos.

**Appendix C**

## INLAND WATERWAYS AUTHORITY OF INDIA
## IWAI, Sub-Office, Varanasi
## Cargo movement from M.M.T. Varanasi after its inauguration

**Updated 25.01.2025**

| S No. | Period (Arrival & Departure at Varanasi) | Origin | Destination | Commodity | Vessel | Waterway Distance (km) | Cargo volume (Tons) | Shipper | Vessel Operator | Flagged off by |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 10.11.2018 | GR Jetty Kolkata (NW 1) | MMT Varanasi (NW 1) | FMCG(Food Products containerized pilot movement) | MV RN Tagore | 1176 | 116TU | M/s Pepsico | La Mer | - |
| 2. | 17.11.2018 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Bagged Urea, FMCG(Food products) containerized pilot movement | MV RN Tagore | 1176 | 16TEU | M/s Pepsico, Dabur Honey,& IFF | La Mer | Hon'ble Prime Minister of India |
| 3. | 30.01.2019 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Empty Containers/ containerized pilot movement | MV RN Tagore | 1176 | 16TEU | M/s Marersk Line India Pvt Tld | La Mer | - |
| 4. | 12.02.2019 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Empty Containers/ containerized pilot movement | MV RN Tagore | 1176 | 16TEU | M/s Marersk Line India Pvt Tld | | Sh. S.B. Shukla, M.T, IWAI |
| 5. | 12.08.2020 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Empty | MV RN Tagore | 1176 | - | - | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6. | 28.12.2020 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Urea | MV RN Tagore | 1176 | 25 MT | M/s SCI | | Sh. S.B. Shukla, M.T, IWAI |
| 7. | 18.02.2021 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Empty | MV LB Shastri | 1176 | - | M/s SCI | | - |
| 8. | 19.02.2021 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Rice Husk | MV LB Shastri | 1176 | 40 MT | M/s SCI | | - |
| 9. | 12.01.2023 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Empty | MV RN Tagore | 1176 | 10 TEU | M/s SCI | - | - |
| 10. | 17.01.2023 | MMT Varanasi (NW 1) | Patna (NW 1) | Cattle Feed<br>Cornflakes<br>Water Bottle | MV RN Tagore | 323 | 25 Ton<br>4.8 Ton<br>10 ton | M/s SCI | - | Sh. Rakesh Kumar, SHS, IWAI |
| 11. | 06.04.2024 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Food Products | MV RN Tagore | 1176 | 24 MT | M/s ITC | | |
| 12. | 09.04.2024 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Fertilizers | MV RN Tagore | 1176 | 136 MT | M/s ITC | | |
| 13. | 08.01.2025 | Kolkata (NW 1) | MMT Varanasi (NW 1) | Coal | MV Homi Bhabha | 1176 | 200 MT | M/s Anand Carbo Pvt Ltd | - | - |
| 14. | 25.01.2025 | MMT Varanasi (NW 1) | Kolkata (NW 1) | Silica Sand | MV Homi Bhabha | 1176 | 90 MT | M/s Mangalore Minerals Pvt Ltd | - | - |

**Appendix D**

# Design Details of Jetty at MMT, Varanasi

- Length of Jetty: 300m
- Width of Jetty:-35m (Additional 7 m width available making the width of jetty 42m)
- Top Level of Jetty:+ 75m
- Berth Capacity of Jetty: 1.26 MTPA
- Low Water Level: + 58.22m
- High Water Level: + 73.9m
- Number of Piles: 72 Piles
- Number of Pile Muffs: 72
- Founding level of Piles: +22.5m
- Approximate length of each pile: 50m
- Diameter of each pile: 1.14m
- Fenders: 18
- Bollards: 10
- Ladders: 03
- Number of mooring rings: 60
- Hand rails: 84m
- Expansion Joint: 42m

**Appendix E**

## Status of Community Jetties and Onshore Facilities in Uttar Pradesh

| Sl.No | Location | District | Jetty Type | Status of Handing over | Type of On Shore Facility | Date of Handing over | Status of ongoing construction activities of Onshore facility |
|---|---|---|---|---|---|---|---|
| 1. | Ramnagar | Varanasi | Steel Pontoon | Handed over to Nagar Nigam, Varanasi | Waiting Shed | 23.01.2024 | Waiting shed super structure completed. Finishing in progress |
| 2. | Ravidas Ghat | | Steel Pontoon | Utilised by M/s Alaknanda Cruise Line Pvt Ltd | Waiting Shed | - | Proposal for changing the site location sent to HQ. on 14.08.2024 |
| 3. | **Assi** Ghat | | HDPE | Handed over to Nagar Nigam, Varanasi | NA | 23.01.2024 | |
| 4. | Lalita Ghat | | HDPE | Handed over to Nagar Nigam, Varanasi | NA | 23.01.2024 | |
| 5. | Dashashwamedh Ghat | | HDPE | Handed over to Nagar Nigam, Varanasi | NA | 23.01.2024 | |
| 6. | Rajghat | | HDPE | Handed over to Nagar Nigam, Varanasi | Waiting Shed | 23.01.2024 | Proposal for changing the site location sent to HQ. on 14.08.2024 |
| 7. | Namo Ghat | | HDPE | Handed over to Nagar Nigam, Varanasi | NA | 23.01.2024 | |
| 8. | Kaithy | | HDPE | Handed over to BDO, Cholapur | Terminal Building | 08.04.2024 | Civil and finishing works completed. Solar works pending. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9. | Balua Ghat | Chandauli | HDPE | Handed over to Zila Panchayat, Chandauli | NA | 30.12.2024 | - |
| 10. | Saidpur | Ghazipur | HDPE | Handed over to Nagar Panchayat, Saidpur | Terminal building | 21.06.2024 | Proposal for changing the site location sent to HQ. on 14.08.2024 |
| 11. | Chochakpur | | HDPE | Handed over to BDO, Karanada, Chochapur | Terminal building | 06.08.2024 | Civil and finishing works completed. Solar works pending. |
| 12. | Zamania | | HDPE | Handing over of jetty in progress | Terminal building | - | Civil and finishing works completed. Solar works pending. |
| 13. | Ghazipur (Collector Ghat) | | HDPE | Handed over to Nagar Palika Parishad, Ghazipur | Terminal building | 31.07.2024 | Civil and finishing works completed. Solar works pending. |
| 14. | Saraikota | Balia | HDPE | Handed over to Sarakotia | Waiting Shed | 30.06.2024 | Civil and finishing works completed. Mural works pending. |
| 15. | Bharauli (Ujjiyar Ghat) | | HDPE | - | NA | - | Superstructure work in progress |
| 16. | Mahjoua | | HDPE | - | Terminal Building | - | Approval to be received from Competent Authority for shifting of facilities from Mahjoua to Ujjiyar Ghat |