

**INLAND WATER TRANSPORTATION ECONOMIC ANALYSIS
(REFERENCE TO VARANASI)**

A Thesis

Submitted towards the requirement for the Award of Degree of

DOCTOR OF PHILOSOPHY

In

ECONOMICS

Under the Faculty of Arts

By

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Under the supervision of

Dr. Chandra Kant Awasthi
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P.K UNIVERSITY



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PRAKRITIK MISHRA

ALPHABETIC INDEX

1	BEACH	Beach Chain Operate
2	BEACHT	Beach Chain Operate Transfer
3	BECH	Beach Chain Operate
4	CAGR	Compound Annual Growth Rate
5	CFS	Customer Freight Stations
6	DFP	Design Build Finance
7	DFPC	Design Build Finance Operate
8	DFPO	Design Build Operate
9	DEA	Department of Economic Affairs
10	DPE	Direct Project Report
11	DFPC	Design Build Finance Operate
12	DFPO	Design Build Operate
13	DFPC	Design Build Finance Operate
14	DFPO	Design Build Operate
15	DFPC	Design Build Finance Operate
16	CFO	Chief Financial Officer
17	DFPC	Design Build Finance Operate
18	DFPO	Design Build Operate
19	DFPC	Design Build Finance Operate
20	DFPO	Design Build Operate
21	DFPC	Design Build Finance Operate
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36	DFPO	Design Build Operate
37	DFPC	Design Build Finance Operate
38	DFPO	Design Build Operate
39	DFPC	Design Build Finance Operate
40	DFPO	Design Build Operate
41	CAGR	Compound Annual Growth Rate
42	CFS	Customer Freight Stations
43	DFP	Design Build Finance

List of Table

Table No.	Particular	Page. No.
1	Logistics Performance Index released by World Bank	4
2	Tabular Analysis of Logistics Performance Index Rankings & Scores	5
3.	Details of carriage capacity of different modes of transport	10
4.	Utilization % of IWT Sector by Various Nations	13
5.	Country wise analysis of waterways length and annual freight movement	14
6.	Comparative economic benefits of different modes of transport	15
7	Dredging Organization Plan along NW-1	18
8	List of district along NW-1	21
9	Details of Sample Survey	99
10	Listing of holistic approach adopted for data collections	100
11	Planed stages of research steps	105
12	Research plan followed	108
13	Structure of Research Report	110
14	Average cumulative primary traffic data recorded in survey for every 15 minutes duration during peak hours (Morning, Afternoon & Evening)	118
15	Truck counts survey was conducted for both ways Up and Return in different Timings along the NH7 passing through MMT Varanasi	122
16	Assessment of Regional Cargo Potential	128
16.1	List of O-D Pairs & Cargo Type Identified by Research Investigation	133
17	Table showing the list of viable O-D pairs, Cargo re-routing through MMT Varanasi	143
18	Supply Chain & Cost Analysis for Marigold Flower Transportation	154
19	Primary Survey and O-D pair Assessment of present cargo that may shifted on IWT mode	163
20	Illustrative case of Potato for cost assessment of vegetable transportation from Saidpur to Varanasi by using different transport modes	166
21	Trade margin % taken by various marketing intermediaries	187
22	Cost incurred at different levels of marketing intermediaries	189
23	Pattern of Tourist Visits at Varanasi	203
24	Case study and tabular analysis of Logistics Cost Incurred with different modes of transportation on Timbers sourced by Merchants at Chauka Ghat Lakdi Mandi at Varanasi	216
25	Details of Crop Pattern & Fertilizer Supply in India	229
26	Estimation of IWT freight for model shift fertilizer cargo on IWT routes along NW-1	230
27	Annual Traffic Movement along NW-1	233
28	Traffic Share along NW-1	234
29	Monthly Traffic Movement along NW-1	234 & 236

30	Vessel Movement at Farakka Navigational Lock Gate	236
31	Number of different types of vessel crossed Farakka navigational lock gate	237
32	Month wise statement of IWT traffic at Farakka Navigational Lock Gate for 2018 & 2019	237
33	Pilot Movement Tabular Analysis - 1	238
34	Pilot Movement Tabular Analysis – 2	238
35	Pilot Movement Tabular Analysis – 3	238
36	Average Vessels Size Moved on National Waterway 1 in Past 2 Years	240
37	Savings in CO2 emission	241
37.1	Sample Population for Survey	244
37.2	Local Demand Assessment – Local Populations Reasons for Crossing of River Ganga at Varanasi	254
37.3	Stakeholders Demographic Assessment –Age Group of Sample Participated	255
37.4	Stakeholders Demographic Assessment – Education Profile of Respondent	256
37.5	Cargo Potential Analysis of Varanasi through Truck Counting Survey	267
37.6	Assessment of traffic potential in respect to Varanasi MMT region	268
37.7	Tabular Analysis of Economic Viable Origin - Destination Pairs	271
38	Details of Major routes	281
39	Measures of freight energy efficiency (In BTUs per Net Ton-Mile)	288
40	Annual emission of pollutants & monitoring of air quality, Source: research paper on Environmental Advantages of Inland Barge Transportation, Maritime Administration and US Transport Department	291
41	Emission of pollutants, release by various transportation modes, while moving of per ton cargo over thousand miles) Source: United States, Environmental protection agency, emission control Lab	291
42	Major List of Turtle Species are Found in Varanasi Region, Source: Kashi Wildlife Division Office and IWAI Office	297
43	Social Costs In Relation To Transport Modalities	301
44	Sensitivity of Inland Water Transport at Varanasi and its associated linkages with Socio-Economic aspects	302
45	Mean Weightage Percentage of Stakeholders Perception for Transport Selection	304
46	Key Role of IWT Mode of Transport for Smart City Development	308
47	Indicative list of potential ferry site.	313
48	IWT Sector other associated economics benefits along National Waterway-1 & Varanasi region	331
49	Details of Major Manufacturing Cluster	332

50	Exiting IWT Asset Utilization Matrix & Economic Benefits along National Waterway-1 Hinterlands	336
51	Economic attributes valued by stakeholders while selecting different modes of transport for their freight shipment	347

List of Figure/Chart

Fig. No.	Particulars	Page No.
1	Regional population crossing river Ganga at Varanasi regional hinterland	2
2	LPI data released by World Bank	4
3.	Comparison of India LPI indicators with Germany	5
4.	Effectiveness contours of Supply Chain Management	6
5.	Comparative carriage capacity of various modes of transport in similar horse power	8
6	Volumes of Cargo Transported by various transport modes with 1 litter of fuel	8 & 9
7.	Comparative economic carriage capacity	9
8.	Per metric tons per Kilometre cost of transportation with different modes of Transports	11
9	Model Share of Freight Movement in % on Various Modes of Transport In India	12
10	Model share % freight transportation on IWT by various countries	13
11	Advantages of Inland Water Transportation	15
12	Overview of Jal Marg Vikas Project for development of IWT Infrastructure on NW-1	17
13.	View of dredging operation in Progress along NW-1	17
14	Map of National Waterway-1	20
15	NW-1- State wise length	21
16	Catchment area of NW 1 under Jal Marg Vikas Project	22
17	View of IWT Multimodal Terminal Varanasi	23
18	View of IWT Multimodal Terminal Sahibganj	23
19	View of IWT Multimodal Terminal Haldia	24
20	View of Old Navigational Lock Gate, Farakka	25
21	RIS Developed along NW-1	25
22	DGPS & River Information Stations Installed along NW-1	26
23	RIS+DGPS Equipment & real-time Metrological Monitoring of National Waterway 1	26
24	Ro-Ro Operations along NW-1	27
25	Ferry Services Operations along National Waterway 1	27
26	Ship Repair Facility & Maintenance Facility	27
27	Fuel Bunkering Station along NW-1	28
28	Model Plan for development of Freight Village at Varanasi	30
29	State wise Average Length of NW-1	32
30	Map of India Indicating 111 National Waterways	33
31	Town Plan of Lothal, Harappa Civilization Site	39
32	The ancient Indus port of Lothal picture as envisaged by the Archaeological	39
33	Multimodal layout in combination with roadways and railways Infrastructure	40

34	Multi-Model Freight Operations by using model mix of Roadways and Railways	41
35	Multimodal layout to be followed with IWT MMT Varanasi	41
36	Inauguration of IWT Multi-Model Terminal on River Ganga at Varanasi	42
37	The shipper follows combined multi-model logistics layout by using MMT Varanasi	43
38	Site Layout of IWT Multimodal Terminal at Ramnagar, Varanasi, U.P	44
39	Gross State Domestic Product of Uttar Pradesh	46
40	District wise Map of Uttar Pradesh	49
41	Key GAP in Sub-Sector Infrastructure In Uttar Pradesh	50
42	Major Zones of Core Industries in Uttar Pradesh	51
43	Movement of IWT Vessel along National Waterway-I	52
44	Key Industrial establishment, MSME and various economic clusters found in the potential districts of eastern Uttar Pradesh	53
45	Map of Varanasi City	55
46	Population Demography of Varanasi City	56
47	View of Ganga Aarti, religious and cultural activities are carried out every day along the Ganga Ghats of Varanasi)	57
48	Satellite Images of Varanasi City	58
49	Traffic movement along Cant Railways Station, Varanasi	59
50	Percentage Share of Expenditure Incurred in different sectors in Private Final Consumption Expenditure FY-2016-2017	64
51	View of active cremation site along the Ghats of Ganga at Varanasi	68
52	Photographs of Field Survey along Varanasi Ghats	69
53	Map of Varanasi River Front & Details of World Heritage Sites	71
54	Glimpses of Ganga Ghats at Varanasi	71
55	Tulsi Manas Mandir, Varanasi	72
56	Sankat Mochan Mandir, Varanasi	72
57	Durga Kund, Varanasi	72
58	Dhamekh Stupa, Sarnath, Varanasi	73
59	Banaras Hindu University	73
60	View of Ganga Aarti at Varanasi	74
61	Cultural Zones of Varanasi city	75
62	Development of Water Ambulance Service at Varanasi	78
63	Emirates Floating Hospital on Ships	80
64	New York Floating Hospital on Ships	80
65	Floating Hospital deployed in Boston Harbour during Covid-19 Pandemic surge	82
66	Floating School, Imparting School Education with Mobile Resources at Bangladesh	84
67	Floating School Deployment on IWT Barge	84

68	School Boats Deployed for Imparting Education to the Rural Children	85
69	Bangkok Khlong Lat Mayom Floating Market for local food and groceries	85
70	Amphawa Floating Market Bangkok for Best Local Seafood	86
71	Koh Kret Island Floating Market – A Great Place for Hanging Out	86
72	IWT based economic development prospects at Varanasi	87
73	Mapping of IWT Stakeholders	94
74	Flow Diagram of research design	96
75	Flow Path of Research Methodology	97
76	Identification of Research Problem	106
77	Method developed for identifying Economic O-D pairs, Cargo Potential, Logistics Cost Assessments etc.	107
78	Relationship of Transport modes with Load, Distance and Speed	112
79	Indicating Study Area “IWT Impact on Regional Economic Development of Varanasi	114
80	Indicative Map of three bridge connecting Varanasi city with eastern regional bank of the river Ganga	115
81	Model Share of Traffic of Varanasi City	116
82	Traffic of Varanasi City & Paratransit mode of local transport	117
83	Google Earth Satellite View of Multi Modal Terminal at Ramnagar, Varanasi	119
84	Method used to identify eligible Origin & Destination Pairs, Divertible Traffic, Cargo Type, Cargo Potential and Comparative Logistics cost with IWT & Roadways	120
85	Process adopted for identifying regional traffic	121
86	Truck Movement in Varanasi Region passing through NH7	122
87	Survey Vessel of Inland Waterways Authority of India birth at Floating Pontoon at Ramnagar, Varanasi	123
88	Types of Cargo Traffic Identification in Varanasi Region	124
89	Divertible Origin & Destination Pairs along NW-1	125
90	Indicative Freight Corridors and Freight Flows Pattern in region	125
91	Integration of four different modes of Transport at Varanasi MMT	126
92	Assessment of cargo traffic movement nearby nodes of MMT Varanasi, via through NH-7	127
93	Major Commodities Transported through Varanasi Region	129-131
94	Hub-Spoke Logistics Model	134
95	Estimation of different types of divertible cargo for MMT Varanasi Riverine Port	136
96	Percentage Share of different types of divertible cargo at MMT Varanasi	137
97	Average cost with different mode of transport identified through research	139

98	Details of freight flows in Upstream and Downstream directions	144
99	Identification of major cargo moved in Upstream and Downstream directions	145
100	Commercial activities along Varanasi Ghats, Source: Colombia University Report	146
101	Pia Chart Analysis	147-148
102	IWT Sector have positive Impact on various economic variable	150
103	Inland Water Transport has economic impact on Regional Supply Chain of Local Produce	150
104	View of Marigold flower cultivation along the Gramsabha's land on NW-1 hinterland	152
105	View of Wholesale flower Market (Kissan Phoo Mandi) at Varanasi	153
106	Core Inefficiency in Local Supply Chain of Marigold Flower	155
107	Month wise estimated demand and Supply Gap for Marigold Flower at Kissan Phool Mandi, Varanasi	156
108	A Value Chain Analysis of Marigold Transportation	157-158
109	Analysis of Annual Cost Incurred on Transportation of Marigold Flower from Kaithi to Varanasi with different modes of Transport	159
110	Local Population Travelling in Country Boat to reach Varanasi from Kaithi)	160
111	View of Vegetable cultivation Sites near Bank of Ganga & Gramsabhas	161
112	Supply Chain of Vegetables Trade & Transport arrangements at Varanasi	164
113	Proposed IWT Logistics arrangements for regional vegetable growers at Varanasi region	165
114	View of Sabzi Mandi Saidpur Ghazipur Uttar Pradesh	166
115	View of Vegetable Wholesale Market Saidpur Ghazipur	167
116	Comparative Analysis of Roadways & IWT	170
117	View of Milk Trades in Varanasi region	172
118	Picture of Parag Milk Products brand of Varanasi region	172
119	Understanding of Value Chain of Milk co-operative society business of Parag Dairy)	173
120	Present Model of Supply Chain followed at PARAG Dairy at Varanasi.	174
121	View of Dairy Farming near Village- Kaithi, Varanasi	175
122	Representation of IWT routes, water transport linkages with Milk Collection Centre likely to be developed along banks of rural hinterlands on river Ganga)	176
123	Future arrangement of Supply Chain with integrating Inland Water Transport	177
124	Willingness of Milk Producer in using IWT services for Transporting Milk Produce	177

125	Graph showing feedback of Milk Producer regarding IWT	178
126	Comparative of Roadways & IWT Mode	179
127	Blue revolution Integration with IWT mode	180
128	Challenges of fisherman community	181
129	Benefits of developing riverine fisheries along NW-1	183
130	Classification of fisheries market	184
131	Intermediaries of Fisheries Marketing Channels	185
132	View of fishing boats	186
133	Fisheries Value Chain	188
134	Gangetic delta along NW-1	190
134.1	Bar Chart representing annual growth rate of fishing sector in India	192
135	Interactions with fisherman community along NW-1	194
136	Fisherman catching fish along NW-1 hinterland	196
137	Fisherman selling fishes along NW-1 hinterland	199
138	Panoramic view of Ganga Ghat	202
140	Pattern of Tourist Visits at Varanasi	203
141	Tourist Visit at Sarnath	204
142	Night View of River Ganges	205
143	Survey Graph of Community Survey	206
144	Preferred tourism destination at Varanasi by Tourist)	207
145	Night view of Ganga Ghats	208
146	Willingness of Visitors for taking Boat/ferry Rides	209
147	View of Alaknanda Kashi Cruse Vessel Playing at Ganga)	211
148	Country boats loaded with timber/wood logs/firewood are parked at Manikarnika Ghat and Harishchandra Ghat	214
149	Pie Chart-Timer Merchant Varanasi sources timber from various states	215
150	View of Chauka Ghat Lakdi Mandi Varanasi	217
151	Annual demand of Coal & analysis	219
152	View of Chandasi Wholesale Market near Varanasi	220
153	Value Chain Analysis for Coal Transportation from Jharkhand to Varanasi	221
154	Coal transportation analysis of O-D pairs, IWT Advantages and Bottlenecks etc.	224
155	View of barge carrying coal along National Waterways -1	225
156	Details of Crop Pattern & Fertilizer Supply in India	229
157	Indicative Routes of Various Modes of Transport's	231
158	Annual Traffic on National Waterway-1	233
159	Traffic Share on NW-1	234
160	Month wise traffic movement on National Waterways 1 (Jan – Dec 2019)	235
161	Yearly Traffic Share Distribution along NW-1	235
162	Traffic Movement Monthly Statement	236
162.1	Stakeholders Participation Analysis	244
162.2	Model Share of Traffic at Varanasi	245

162.3	Average share of city traffic along major nodes during peak hours	246
162.4	Average Traffic Composition BHU Lanka crossing	247
162.5	Average Traffic Composition at Godawalia Market	247
162.6	Average Traffic Composition at Shivala Ghat	248
162.7	Average Traffic Composition at Padao Crossing	248
162.8	Average Traffic Composition at Ramnaga Chauraha	249
162.9	Average Traffic Composition at Tengra Mode	249
162.10	Average Traffic Composition at Shashtri Chowk	250
162.11	Average Traffic Composition at Varanasi Junction	250
162.12	Average Traffic Composition at Mughal Sarai	251
162.13	Average Traffic Composition at Kashi Station	251
162.14	Average Traffic Composition at Sonarpura	252
162.15	Average Traffic Composition at Teliabagh	252
162.16	Average Traffic Composition at Raja Talab	253
162.17	Local Demand Assessment – Local Populations Reasons for Crossing of River Ganga at Varanasi	254
162.18	Stakeholders Demographic Assessment – Gender Participation of Sample Population	255
162.19	Stakeholders Demographic Assessment –Age Group of Sample Participated	255
162.20	Stakeholders Demographic Assessment – Education Profile of Respondent	256
162.21	Stakeholders Demographic Assessment – Income Level of Respondent	256
162.22	Stakeholders Demographic Assessment – Occupation of Respondent	257
162.23	Stakeholders Demographic Assessment – Category of Respondents	257
162.24 to 162.36	Stakeholders Perception Survey for Inland Water Transport Development at Varanasi	258 to 264
162.37	Inland Water Transport is complimentary for Tourism Sector in generating regional income & employment opportunities	264
162.38	Preferred tourism destination at Varanasi	265
162.39	Visitors' willingness for taking boat ride at Ganga Ghat	266
162.40	Cargo Potential Analysis of Varanasi through Truck Counting Survey	267
162.41	Analysis of divertible cargo traffic on Waterways through MMT Varanasi	269
162.42	Analysis of Freight Flows Upstream Vs Downstream	274

163	Strategic Location of Varanasi for Development of Riverine Port Development along river Ganges.	276
164	Integration of Golden Quadrilateral at MMT Varanasi	277
165	Benefits of IWT Transport Integration	278
166	Maps Indicating NW-1, MMT Varanasi. possibility of IWT trades and transport connectivity with neighbouring countries	279
167	List of road routes followed by neighbouring countries for handling logistics for bilateral trades	281
168	Indicative logistics routes of Bangladesh for handling bi-lateral transit cargo traffic of neighbouring countries	282
169	Integration of NW-1, IBP Protocol Route and NW-2 for expanding logistics networks in eastern and north east regions and also facilitates bi-lateral trades with Nepal, Bhutan, Bangladesh and Myanmar	285
170	Portrait of Varanasi Roadmap and National Waterways-1	286
171	Details of Waterway Connectivity	287
172	Standard Freight Transportation in Kms/Gallon fuel consumption with different using transportation modes, Source: Final Report, Maritime Administration, U.S Department of Transportation	289
173	Strong Environmental Measures and Effective Conservation of Natural Resources	294
174	Notified area of Kashi Turtle Sanctuary by the Govt. of U.P)	295
175	Picture of Turtle in Kahhuwa Sanctuary at Varanasi	296
176	Stakeholders Perception Mapping at Varanasi for Inland Water Transport	299 & 303
177	Establishment of Haat's and Local Bazaars along the Ghats of Varanasi city	304
178	Picture of IWT routes facilitates logistics for crimination activities at Benaras City	305
179	Integration of proposed metro lines, proposed roads and railways lines with Inland Water Transport nodes	309
180	Integration of Metro Routes with Ferry Transport System at Varanasi	311
181	Indicative economic benefits of ferry transport at Varanasi city	312
182	Route Assignment of Ferry Transport/Ro-Ro Transport at Varanasi City	313
183	SWOT Analysis	315
184	View of ODC Cargo Movement	316
185	Overview of Jal Marg Vikas Project along National Waterway-1	319
186	Container unloading at MMT Sahibganj, along NW-1	321
187	View of under construction MMT Haldia on NW-1	321
188	View of Ro-RO Vessels Playing on NW-1)	322

189	Master Plan of Arth Ganga Programme along National Waterway-I	325
190	Arth Ganga broader economic benefits at Varanasi Region	326-327
191	India's population split in half	327
192	IWT Plan for development of regional trades through enhanced river transport	328
193	Plan of regional freight diversion along NW-I at Varanasi region	334
194	Primary hinterland economically benefitted by development of freight Village at Varanasi	339
195	Indicative Map of Freight Village at Varanasi, located near to the IWT Terminal	340
196	IWT Survey Vessel Navigating near Raj Ghat Bridge at Varanasi	341
197	Construction of Varanasi MMT on going by M/s AFCONS Ltd	341
198	Holistic Plan of IWT Sector development along NW-I, where Varanasi is one of major key node on O-D pairs development)	345
199	IWT Economic Benefits at Varanasi	345



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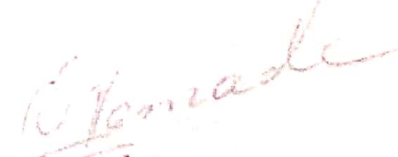
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Abstract

Transportation networks are termed as nervous system of countries economy, Indian government are imperative drivers for strengthening logistics infrastructure for national interest. The research intended for studying IWT economic benefits that reap out by development Water Transport network at Varanasi region. Despite achieving millions milestone but, the logistics performance Index of India are ranked on 44th Position in 2018, secondly the expenditure incurred by transportation are measured that to be approximate in between 15 to 18 percent cost of country GDP, therefore, it become high time for augmenting river resources for transportation purposes. The stakeholders associated directly or indirectly with Gangetic basin are being benefitted with development of Inland Water Transport, the country have presently 14500 Kilometre of navigable waterways including 4000 kilometre of canal system. It was analysed that transportation cost incurred per ton-per kilometre with roadways is INR 2.50, railways is INR 1.36 and Waterways is INR 1.06

In 2016 the government has enacted national waterways act where declared 111 rivers as national waterways, therefore it become priority sector for government for development of required infrastructure for Inland navigation purposes. Development of river ports in new city like Varanasi yield several economic fruits for regional development and spurt opportunity for connecting landlocked areas with seaborne trades.

The development of Inland Water Transport sector at Varanasi region leads for timely delivery of freights, that offers quality logistics services, efficient foreign trade management, lowers transportation and distribution cost etc.

Inland Water Transportation sector termed to be complementary mode of transport that offers multimodal transport with taking support of railways and roadways, the inland transport infrastructure are neglected for in use after long development of railways and roadways networks, however, in maritime history the riverine transportations are only ways of trading along the civilizations established historically.

Varanasi being heritage city where urban establishments are very congested, the city core are established near to the banks of river Ganga, the investigations findings shows that traffic of the city are actually snoring and choked at surge traffic hours, the most religious and economic activity of the regions are performed near to the Ganga Ghats. The regional populations of the city regularly visits to the city every day for catering various kinds of their needs, they usually cross the river banks using availed localized wooden boats, also the religious activities are performed along river front, therefore it enhance significance of using water transport at Varanasi.

The Varanasi city traffic profile are using mixed type of transport means, but there are lacunae exist in organized public transportation profile, the use of para-transits modes are very common and city lanes are highly congested therefore the transit time for commuting from one place to another place drastically increases.

The city is attractor for tourism activity and the industry established in the regions that becomes source of employment for local population, the highways and railways networks in the city are already developed at many extent and the dense establishments of the city skewed highly towards areas were roads and Rails were already developed, but these modes are bearing huge pressure for catering daily city traffic and populations over the time likely to be increased, the development of water borne transport facility not only helps to the common citizens of the city but also facilitates ease of doing business and trades across the river banks. With development

of river transport networks optimizes connecting link to enhance utilization of resources located on opposite banks.

The research have extensively studied model shift of various economic activity and patterns that being carried out majorly, it tried to establish linkages with IWT modes of transport networks in falling chapters, the details and economic benefits were drawn for understanding significance of IWT development at region.

Several unprivileged community are living around the Gangetic basin, they are poorly socio-economically benefitted and disconnected with flow of economic activity, the community of boatman, and fisherman and hinterland farmers are largely benefitted across the river basin by re-inventing the wheels of developing IWT sector.

Investment in Development of Inland Water Transport Infrastructure at Kashi region fosters economic clusters for their competitive benefits, Varanasi MMT located on focal plane which is the rarest possibilities in the world exits, where the shipper may offer of getting opportunity as availability of all options for modes of transport at one place i.e Railways, Roadways, Waterways and Airways located at same region.

The assumptions have been taken during research for understanding ways that gain economic advantages to the regional populations, which helps for achieving development of Inland Water Transport networks at Varanasi, the research investigations findings indicates that IWT sector stimulates economic activity in the region, the development of Inland Transport advent intermodality in exiting transport profile of the city.

The vessel operations in river leads indirect benefits maintaining unrestricted flows of river, the IWT frameworks development offers several economic benefits, optimises natural resource utilization with minimal environmental impact. The IWT sector will also being adding efforts with Ganga clean mission and Ganga Mitra for river restoration activity with offered benefits of economic integration of cargo carriages with IWT vessels and meets industry supply chain.

IWT leads for development of local community jetties and freight village at Varanasi that leads for adding additional economic activity along Gangetic basin. The probabilities of evolving following several economic benefits by development of Inland Water Transport Sector at Varanasi region are mentioned below:

- Augments economic development along the hinterland of the multimodal terminal at Varanasi by promoting employment generation and SME sector growth
- Reduce logistics cost in the eastern transport corridor and its influencing zone
- It Promote utilization of waterway transport on river Ganga (NW-1) between Haldia and Varanasi and of rail transport on Eastern Dedicated Freight Corridor (EDFC) in the North bound direction which facilitates movement of freight from road to water and rail
- Develop Varanasi as a cargo aggregation and trans-shipment hub to boost the local economy and providing a state of the art warehousing facility
- It has been observed that the upcoming freight village at Varanasi shall induce a spur in local economy by potentially generating 3600 direct and indirect additional job opportunities. The employment opportunities are envisaged in works like administration, safety & security, cargo handling etc. It shall also promote growth of local SMEs in the hinterland due to Varanasi being developed as a transshipment hub.
- Nepal and Bhutan Being land locked neighbouring countries their international freight transport relates on services managed with India's helps, therefore incorporating of MMT Varanasi, Inland Water Transport facility manages logistics of neighbouring countries and possibly extend opportunities for developing diplomatic relationships

- Minimal environmental Impact during freight transportation with IWT vessel and barges. The activity of river bank protection works and river flow management leads for economic advantages too with operationalization of Inland Vessel and Barges etc.
- The development of IWT sector at Varanasi region leads for evolving waterborne commerce to the existing economy and has significance for socio-economic benefits to the community established along the rivers.
- Utilization of water resources for transportation purposes is win –win situation for Indian economy, the most of advanced developed nation has realized the potential of inland water transport in optimizing utilization of country resources to its maximum extent.
- The development of IWT Infrastructure at Varanasi region attracts larger investments through PPP projects development, that fosters regional industry and economy that may benefitted entire local economy distinctly.
- The developed and institutionalized water transport system may generates several economic opportunity and generates several employments etc.
- The model shift of cargo may happen in the region where several economic units may established and leads for generating revenue to the states in form of payment of increased tax revenues etc.
- The cargo model shift from exiting modes of transport may also leads for reducing the burden of traffic of roadways and railways. It also support for future capacity requirements for trade and commerce development etc.

Table of Content

SL. No.	Particulars	Page No.
1	Introduction	1
1.1	IWT research context setting	2
1.2	Economic benefits of Inland Water Transport	7
1.3	Modality of Freight Transport in India	11
1.4	Utilization of IWT Sector by Various Countries	12
1.5	Advantages of Inland Water Transportation	14
1.6	Comparative economic benefits of different modes of Transports	15
1.7	Jal Marg Vikas Project Initiative for Development of NW-1 for Navigation and Transportation Purposes	16
1.8	Macroscopic View on Economic Investments Made for Augmenting National Waterways-1	22
1.9	Important National Waterways of India	31
1.10	Objective of Thesis	34
2.	Literature Review	36
2.1	Historical review of Water Transportation	37
2.2	Overview of Multi-Modal Transportation	40
2.3	Varanasi MMT a Focal Point for Logistics Sector	43
2.4	Overview of Uttar Pradesh	45
2.5	Industrial Economic Framework of Uttar Pradesh	49
2.6	Overview of Varanasi District (Kashi or Benaras)	54
2.7	Present Cargo Transportation Scenario	60
2.8	Need For Developing River Ganga As National Waterways-1 For Transportation Purposes	62
2.9	Environmental Economic Advantages of Inland Water Transport	65
2.10	Inland Water Transportation Impacts to Improve Business Efficiency of Varanasi	65
2.11	Economic Growth by Catering Demands of Logistics Needs with IWT Sector	66
2.12	Inland Water Transport Nurturing Tourism Business at Varanasi	67
2.13	IWT Sector Enhances Development of Heritage & Cultural Sites at Varanasi	70
2.14	Lead Economic Gains Achieved Through Inland Water Transport	75
2.15	Possibilities of Development of Floating Hospital for combating pandemic situations like COVID- 19	79
2.16	IWT Possibilities of Developing Floating Schools, Colleges and University in India	82
2.17	Possibilities of Development of Floating Market at Varanasi	85
2.18	IWT based economic development prospects at Varanasi	87
3	Research Methodology	88
3.1	Background of Research	89
3.2	Approach used for conducting research study	89

3.3	Development of Research Framework	90
3.4	Development of Hypothesis	91
3.5	Process of Mapping IWT Stakeholders	94
3.6	Research Design and Flow Chart	96
3.7	Research Methodology	97
3.8	Sampling Approach	98
3.9	Statistical Methods used for Data Analysis	102
3.10	Use of ICT in research	103
3.11	SWOT analysis	104
3.12	Research Steps Followed	104
3.13	Identification of Research Problem	106
3.14	Method developed for identifying Economic O-D pairs, Cargo Potential, Logistics Cost Assessments etc.	107
3.15	Research plan followed	108
3.16	Research Outcome	109
3.17	Structure of Research Report	110
4.	Research Findings	112
4.1	Prototypical Share of Vehicle Populations Traffic at Varanasi	114
4.2	Assessment of Cargo Market Potential for Varanasi region	119
4.3	Major Commodities Transported through Varanasi Region	129
4.4	Identification of Key Origin - Destination Pairs and Cargo	131
4.5	Varanasi region emerges for Hub-Spoke Logistics Model	133
4.6	Plan for development of Integrated cum Logistics Park (Freight Village) adjacent to the IWT Port at Varanasi	135
4.7	Assessment of Economical Viable Origin – Destination Pairs with Inland Water Transportation & Re-routing of Cargo through MMT Varanasi	138
4.8	Analysis of Freight Flows Upstream Vs Downstream	144
4.9	Identification of Major Cargo Transported From Varanasi In Upstream And Downstream of NW-1	144
4.10	Inland Water Transport sector fosters regional economy along hinterlands of Ganga in Varanasi region	145
4.11	Inland Water Transport gives ride to the wave of regional economic development and nourished income for local population:	148
4.12	Inland Water Transport has economic impact on Regional Supply Chain of Local Produce	150
4.13	Major Comparative Economic Benefit of IWT over Roadways Transportation Mode for the case of Vegetable Transportation form Saidpur to Varanasi	170
4.14	Economic Impact of Inland Water Transport on Fisherman Community living along the Gangetic basin.	179

4.15	Inland Water Transportation Ignites opportunity for flourishing Tourism sector Economy at Varanasi	201
4.16	Regional Characteristics & Physical Growth Indicator of Varanasi City	202
4.17	Inland Water Transport Emerges Ganga Ghats as Centre of Commerce and Tourism at Varanasi	205
4.18	Inland Water Transport is complimentary for Tourism Sector in generating regional income & employment opportunities	206
4.19	Water Transportation changes movement patterns of the visitors at Varanasi	209
4.20	Inland Water Transportation facilitates in cremation rituals at Varanasi and supports trades of timbers used cremation	212
4.21	Inland Water Transport Optimizes Multimodal Transportation of Coal and Facilitate Material Flow in the region for Making Aatma Nirbhar Bharat	217
4.22	Case study on Fertilizer Transportation from Varanasi to West Bengal	226
4.23	Analysis & Incorporation of Data Interpretation (Secondary Data)	232
4.23.1	Analysis Cargo Traffic Movements on National Waterway-1	233
4.23.2	NW-1 Traffic Mix Analysis	234
4.23.3	Month wise analysis of Cargo traffic movement along NW-1	234
4.23.4	Graphical analysis - Month wise traffic movement on NW-1	253
4.23.5	Month Wise Traffic Movement Statement of Patna Ro & Kolkata Ro	236
4.23.6	Vessel Movement at Farakka Navigational Lock Gate	236
4.23.7	Number of different types of vessels crossed Farakka navigational lock gate	236
4.23.8	Month wise statement of IWT traffic at Farakka Navigational Lock Gate for 2018 & 2019	237
4.24	Analysis of Pilot Movement	237
4.24.1	Pilot Movement Tabular Analysis - 1	237
4.24.2	Pilot Movement Tabular Analysis – 2	238
4.24.3	Pilot Movement Tabular Analysis – 3	238
4.24.4	Eighteen Pilot Movements Tested National Waterways - 1	239
4.24.5	Analysis of Average Vessels Size Moved on National Waterway 1	240
4.24.6	Tabular Analysis	241
4.24.7	Saving in CO2 emission using IWT	241
4.25	Incorporation of Primary Data, its Analysis & Findings	243
4.25.1	Primary Survey Findings No. 1 ” Share of Stakeholders Participation in Collection of Primary Data for Research”	244
4.25.2	Primary Survey Findings No. 2 “Traffic Share of Vehicle Populations at Varanasi City”	245
4.25.3	Primary Survey Findings No. 3 “Traffic Assessment along Major City Nodes at Varanasi”	246
4.25.4	Primary Survey Findings No. 4	254

	“Local Demand Assessment – Local Populations Reasons for Crossing of River Ganga at Varanasi”	
4.25.5	Primary Survey Findings No. 5 “Stakeholders Demographic Assessment – Gender Participation of Sample Population”	255
4.25.6	Primary Survey Findings No. 6 “Stakeholders Demographic Assessment –Age Group of Sample Participated”	255
4.25.7	Primary Survey Findings No. 7 “Stakeholders Demographic Assessment – Education Profile of Respondent”	256
4.25.8	Primary Survey Findings No. 8 “Stakeholders Demographic Assessment – Income Level of Respondent”	256
4.25.9	Primary Survey Findings No. 9 “Stakeholders Demographic Assessment – Occupation of Respondent”	257
4.25.10	Primary Survey Findings No. 10 “Stakeholders Demographic Assessment – Category of Respondents”	257
4.25.11	Primary Survey Findings No. 11 “Stakeholders Perception Survey for Inland Water Transport Development at Varanasi”	258
4.25.12	Primary Survey Findings No. 12 “Inland Water Transport is complimentary for Tourism Sector in generating regional income & employment opportunities”	264
4.25.13	Primary Survey Findings No. 13 “Cargo Potential Analysis of Varanasi through Truck Counting Survey”	267
4.25.14	Primary Survey Findings No. 14 “Assessment of traffic potential in respect to Varanasi MMT region”	268
4.25.15	Primary Survey Findings No. 15 “Analysis of divertible cargo traffic on Waterways through MMT Varanasi”	269
4.25.16	Primary Survey Findings No. 16 “Assessment of Economical Viable Origin – Destination Pairs with Inland Water Transportation & Re-routing of Cargo through MMT Varanasi”	269
4.25.17	Primary Survey Findings No. 17 “Analysis of Freight Flows Upstream Vs Downstream”	274
5	Discussion	275
5.1	Geo –Economic Features of MMT Varanasi, Uttar Pradesh	276
5.2	Integration of Golden Quadrilateral Super Highway with Varanasi MMT	277
5.3	Benefits of Integration of Railways, Roadways with MMT Varanasi	277

5.4	Inland Water Transport develops potential Gateway of Opportunities in Varanasi for Promoting Bilateral Trades with Neighbouring Countries	278
5.5	Potential of Bangladesh in perspective of logistics transit regimen	282
5.6	Indo-Nepal Treaty for utilization of IWT routes for handling bilateral trades	282
5.7	Indo-Bangladesh Treaty for utilization of IWT routes for handling bilateral trades. Or Treaty for Indo-Bangladesh Protocol IWT routes	283
5.8	Environmental Benefits for Promoting Inland Water Transport:	288
5.9	IWT Energy Efficiency & Fuel Utilization	290
5.10	Air & Noise Pollution & Accountability of IWT Sector	290
5.11	Inland Water Transport offers flood control and wild life protection	292
5.12	IWT Environmental Measures taken by Inland Waterways Authority of India during Movement and Playing of Inland Vessels through Kachhua Wildlife Sanctuary at Varanasi	294
5.13	Best practices adopted by IWT Authorities while operating of vessels	295
5.14	De-notification of Kashi Turtle Sanctuary by the Government of Uttar Pradesh	296
5.15	Social benefits perspectives developing riverine or Inland Water Transportation sector at Varanasi City/Rural regions	297
5.16	Inland Water Transport eliminates gaps of geographical divide in between Varanasi and Chanduali district	299
5.17	Linkage of Inland Water Transport with Socio-Economic Activity:	301
5.18	Inland Water Transport Transacts Exchange of Resources between Society and Environment	305
6.	Research Conclusion	306
6.1	Summary of Conclusion	307
6.2	Urban characteristics of Varanasi city	308
6.3	Possibilities of developing integrated modes of transport at Varanasi city	309
6.4	IWT development enable Commercial and Land use of riverfront at Varanasi	310
6.5	IWT stimulates development of Urban Ferry/Ro-Ro Transport Network at Varanasi	310
6.6	Inland Water Transport Strength, Opportunities, Threats Analysis compared with roadways and railways:	314
6.7	SWOT Analysis of Inland Water Transport	315
6.8	ODC & Cryogenic Cargo Movement Boost Economic Growth of Industries in Varanasi Region	316
6.9	Contribution of Inland Water Transportation Sector in Atmanirbhar Bharat (Self Reliant India in Logistics Sector)	317
6.10	Jal Marg Vikas Project Overview and role of Inland Waterways Authority of India	318

6.11	IWT Transport Encourages Investments from Private Sector through Public Private Participation Mechanism	324
6.12	Economic Perspective of River Transport (Conceptualization of Arth Ganga Programme under Jal Marg Vikas Project along National Waterway-1)	324
6.13	IWT Sector facilitates development of domestic & regional trade along Ganga at Varanasi & other regions of National Waterway-1	327
6.14	Inland Water Transport Facilitates Local community's enhancement through Arth Ganga Transport Development Initiative	328
6.15	IWT Sector facilitates Passenger movement at Varanasi and other regions of National Waterway-1	329
6.16	IWT Sector other associated economics benefits along National Waterway-1 & Varanasi region	329
6.17	Development of IWT Sector, Logistics Park and Special Economic Zones at Varanasi region	337
6.18	Major Economic gears of developing Freight Village along with IWT Ports Development at Varanasi:	340
6.19	IWT Sector Building Economically and Environmentally Sustainable Logistics Network in India	342
6.20	IWT Sector Major Economic Benefits	345
6.21	IWT Multimodal Terminal at Varanasi Develops Transportation Intermodals	346
7	References & Webliography	347
8	Questionnaire	353
9	Annexures	
	Certificate of workshops, seminar and conferences etc.	**
	Research Paper Publications in UGC approved journals	**
	Photographs	**

Chapter 1

Introduction:

Inland Waterways Transportation
Economic Analysis
(In context to Varanasi)



1.1 IWT Research Context Setting:

Effective logistics and supply chain networks are the backbone of economy for any country, the developing nation like India which has fastest growing economy then here comes responsibility of the government to driver imperative investments for strengthening infrastructure in the logistics sector.

Countywide sharing of modal freight transportation on various modes has foster sustainable economic development in country, the freight movement through effective and reliable transportation modes are key drivers that led for economic growth, traditionally river based multimodal transportation model are used during historical civilization, since long ages the rivers were catering many needs of the mankind, water transportation mode are already proven fact that they are economical, cost-efficient, environmentally friendly sustainable and reliable modes of transport.

India has achieved so many milestones in the performance of the logistics handling since after independence and achieved trajectory of various economic growth, The World Bank has published Logistics Performance Index report where the countrywide logistics ranking are given where our countries logistics performance rank was improved from 54th position in 2014 to 35th Position in 2016 and again slipped down to 44th position again in 2018. ¹

Hence achieving logistics competitiveness are essentially required for India, the optimization of on time cargo handling, Improvement in process of cargo operations and reduction in overall logistics cost are needed to emphasized for transformative actions in improving logistics competitiveness.

Geographically India has the presence of vast opportunities for utilisation of available water resources of river for transportation purposes, the presence of enormous networks of river, canals, and backwaters, if intently used that will offers county economic cost savings in total spending on transportation budgeted expenditure and in outcome the citizen achieve competitively priced goods, the reduced logistics cost of transportation prevent pilferages and IWT modes of transport offers huge cost savings by lower freight. Additionally, it offers thousand job opportunities and fosters economic investments in the region.



(Fig.No.1 Regional population crossing river Ganga at Varanasi regional hinterland)

¹ World Bank Logistics Performance Index & Its Indicators 2018, <https://lpi.worldbank.org>, International Bank for Reconstruction and Development, Washington, DC 20433.

This research study aims to map and identify various hidden economic drivers which utilises IWT sectors at Varanasi hinterlands, it helps to identify the core economic areas where possible investments can be made along with association of various IWT sector interventions.

Logistics movement through river routes aims to provide sound economic commercialization options to the shipper's for movement of cargo on potentially viable Origin and Destination (O-D) pairs. The comprehensive field survey, market assessment, transportation and economic study sets context for development of Inland Water Transport network at Varanasi.

The country like India having extra advantage for Inland waterways sector due to existence of larger networks of rivers, canals, backwaters etc. Presently the country have total available navigable length of Inland waterways of around 14500 Km of the rivers and 4000 Km of canals which can be proposed for transportation. The Inland waterways is always fuel efficient, cost effective, economical, safe & reliable and environment friendly mode of transportation. Which reduces total logistics cost from country's GDP. The World Bank and Government of India has analysed that transportation of goods through Inland waterways route will incurred INR 1.06 Per-tonne-Km of cost, whereas the railways charges for INR 1.36 per-tonne km and lastly INR 2.50 per tonne-km of the cost coming on roadways respectively. Under the national waterways act 2016 government of India has declared additional 106 new national waterways along with the existing ²

Five national waterways at present there are total 111 National Waterways are declared in India for navigation purposes. The Indian road and railways networks are already saturated over the certain stretches, hence there is regular sufferings of traffic congestions on roadways and delayed movement on railways that results in increasing lead shipment delivery time, also creating enormous environmental pollutions, happening frequent road accidents and increasing risk of other transport associated hazards etc. the co-ordinated approach of IWT multimodal transportation supports for integration of other surface modes and aiding for transporting larger volume of freight for longer distance with minimal possible cost and with lower risk of transportation hazards.

In every two years of interval the World Bank releases logistics performance index for 160 countries world wide, which shows the benchmark logistics of every country that how efficiently domestic and international freight/cargo was handled.

Following were the criteria laid by World Bank for measuring logistics performance scores of that particular country and methodology followed worldwide to locate the logistics service quality of country.

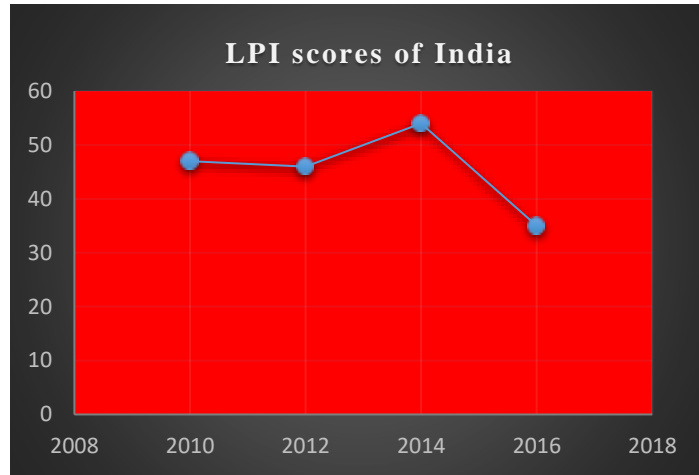
- Timeliness delivery of freight
- Quality of logistics infrastructure
- Ability of tracking of consignment
- Efficiency of customs and border management
- Clearances and ease of international shipment.

² The World Bank Group, [Development Projects: Capacity Augmentation of the National Waterway- 1 \(JAL MARG VIKAS\) Project - P148775 \(worldbank.org\)](https://projects.worldbank.org/en/projects-operations/project-detail/P148775?lang=en) <https://projects.worldbank.org/en/projects-operations/project-detail/P148775?lang=en>

Indian logistics performance is improved by reducing clearance time, optimizing border management and improve supply chain infrastructure i.e improving road surface, railways and ports.

Year wise World Bank Logistics Performance Index Ranking for India

Year	LPI Rank
2010	47 th
2012	46 th
2014	54 th
2016	35 th
2018	44 th



(Table No. 1 & Fig No.2 1 LPI data released by World Bank)

Germany has secured top rank internationally in logistics performance rank by delivering quality services operations under growing demands of supply chain globally. The logistics performance ranks are surveyed by the expert of logistics and supply chain the access the determinants of logistics of each country.

The logistics ranks reflect countries transportation infrastructure performance in efficient handling of freight across the borders or within the country, as logistics are the backbone of the country trades hence LPI is touches many areas of an economy and it relates to the benchmarking of trades infrastructure through its effective logistics services.

The logistics are key for the economic growth and increased competitiveness for business environment, the inefficient logistics have negative effects on trades it may increase the overall cost of trade and reduces the potential of global integration of value chain.

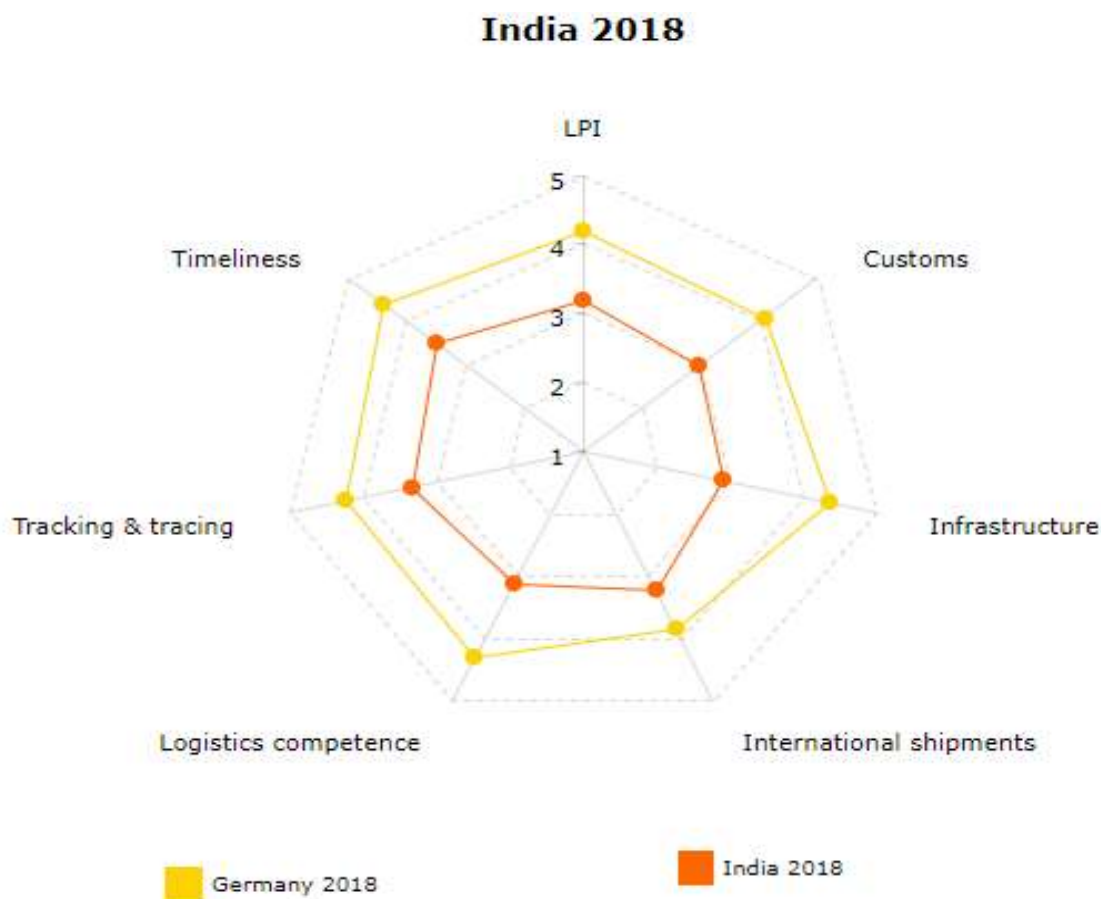
The India's LPI score was improved from 2014 to 2016 due to the initiatives taken for improvement in the logistics infrastructure, make in India Programmes and digital revolution in every field including logistics and supply chain.

As per the LPI report of 2018 India has secured the total score of 3.18 whereas the Germany has scored 4.2 hence India is lags far behind in logistics performance.³

The recent government has taken initiative to improve the necessary transportation infrastructure in the country and empowering their business competitiveness by improvement in custom clearance timings, construction of quality of railways, roadways and waterways networks, development of advanced ports and rail terminals, digitization initiatives in logistics sector.

³ World Bank Logistics Performance Index & Its Indicators 2018, <https://lpi.worldbank.org>, International Bank for Reconstruction and Development, Washington, DC 20433.

India has understood the key focus area of investment and initiated the development of Inland and costal shipping within the National Waterways and started readiness to grab the opportunity of reducing logistics cost and resolving the inefficiencies of freight handling within the country, also the India has focussed on reducing the environmental foot print the carbon emissions done through transport sector.



(Fig. No.3. Comparison of India LPI indicators with Germany)

Tabular Analysis of Logistics Performance Index Rankings and Scores ⁴

Country	Year	LPI Rank	LPI Score	Customs	Infrastructure	International shipments	Logistics competence	Tracking & tracing	Timeliness
Germany	2018	1	4.2	4.09	4.37	3.86	4.31	4.24	4.39
India	2018	44	3.18	2.96	2.91	3.21	3.13	3.32	3.5

(Table No.2. Tabular Analysis of Logistics Performance Index Rankings & Scores, Source - World Bank LPI 2018 Report)

⁴ World Bank Logistics Performance Index & Its Indicators 2018, <https://lpi.worldbank.org>, International Bank for Reconstruction and Development, Washington, DC 20433.

In Logistics Performance Index there are two areas highlighted firstly the areas of policy intervention and regulations for strengthening supply chain of the country and secondly the supply chain performance outcomes by reduction in time, cost and reliability in shipments of consignments.



(Fig. No.4. Effectiveness contours of Supply Chain Management)⁵

Supply chain arrangements are aimed for seamless movement of freight flows at lower cost and resolving the issues of inefficiencies in transportation operations, the transport modes variables Railways, Waterways and pipelines has critically brought down the cost of goods movements and the freight rate determined very low (Per-tonne-Kilometre) cost through improved efficiency and productivity.

Indian government has understood and started focus on the development of transportation infrastructure and taken various policy initiative change to improve global logistics rank of India. The development of Inland Water Transport (IWT) infrastructure is one among the initiative steps of logistics infrastructure Improvement.

For gaining logistics competitiveness Inland Waterways requires public investment to enhance water transport infrastructure such as navigable depth, Inland ports, low draft vessels, aids to navigation for day and night operations, lock gate, ship repair facility, fuel bunkering, river policing, jetties for cargo and passenger vessels, necessary cargo handling arrangements like crane, forklift, reach stacker, cargo handling plant, construction of Warehouse, freight village, storage tanks and preparing effective arrangements for road and railways connectivity along the Inland Multimodal terminals along the potential hinterland of National Waterways

⁵ Research Analysis - <https://timesofindia.indiatimes.com/india/varanasi-to-get-indias-1st-freight-village/articleshow/58935963.cms>

1.2 Economic Benefits of Inland Water Transport:

Inland Water Transport system is the supplementary modes of transport which is having better cost effectiveness, fuel efficient and environmentally friendly modes of transport than the Roads and Railways.

LNG powered vessels are proposed to be used for transportation of cargo on NW-1 hence the efficient vessels have lesser Co2 emission and single vessel can accommodate the cargo of approximate 2000 metric tonnes, hence there will be the substantial options for reducing greenhouse gases

There is lesser Co2 emission by the vessels used for transportation of cargo and reduces the greenhouse gas emissions

Co2 equivalent greenhouse gas emissions per-metric tonnes per kilometres transporting cargo by the following modes.⁶

Roadways	Railways	Waterways
64 gram	28 gram	15 gram

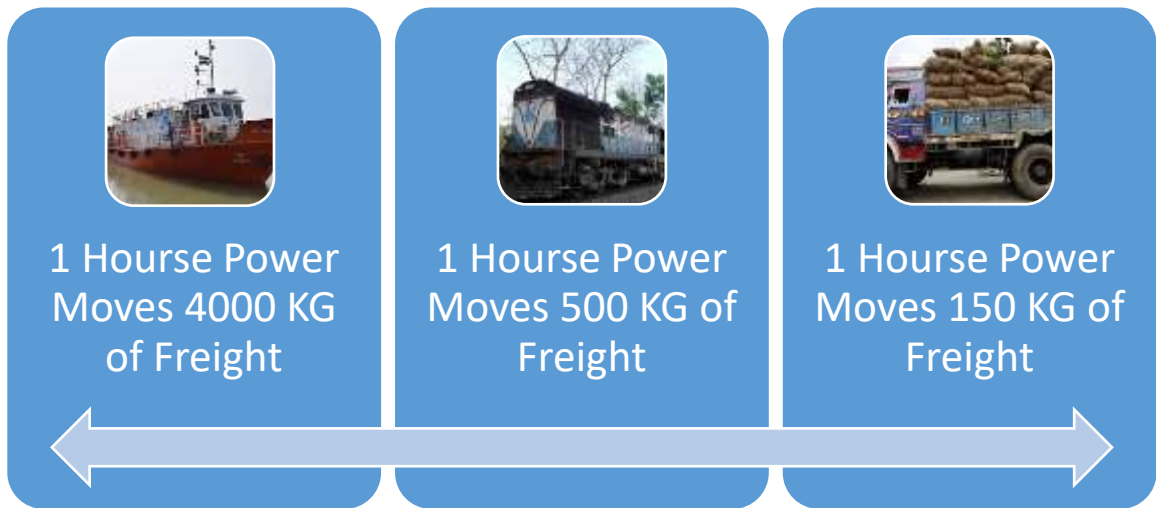
(Source: IWAI, Ministry of Ports, Shipping and Waterways “Published Boucher”)

Inland Water Transport mode if optimally integrated with various other modes of transport it drastically reduce down the total logistics cost in supply chain of bulk, hazardous, over dimensional cargo segments, the integration of IWT with roadways offers reliable first mile and last mile connectivity, whereas integrated railways sidings with River Port offers faster evacuations of freight from ports thereby offers cost economic benefits.

The construction cost of building 1 km motorway and expressway in our country is range from \$ 3.1 million to \$ 9.5 million depending upon the site conditioning, whereas construction of 1km of railways track costs per track km approximately € 472,700 and development of Inland Waterways per km fairways costs approx. \$ 3.2 billion only since waterways has significant lesser capital cost involved in constructions.

IWT offers cost economic benefits in consumption of fuel economy while transporting cargo by using National Waterways as per the Ministry of Shipping, Govt. of India report 1 horse power of engine can carry approximate 4000 Kg of cargo loads on waterways similarly 500 Kg can be transported by using railways and 150 Kg of freight load carried on Roadways with similar capacity of engine.

⁶ IWAI, Ministry of Ports, Shipping and Waterways “Published Boucher” <https://shipmin.gov.in/division/iwt-1>



(Fig No.5. Comparative carriage capacity of various modes of transport in similar horse power, Source: Ministry of Ports, Shipping and Waterways, Govt. of India)

National Waterways 1 (Ganga – Bhagirathi – Hooghly) river system has significant importance for four states and it has potential to serve the needs of major cities in their catchment area, several industries were already located in the hinterlands of National Waterways 1 and development of Inland Waterways

At various stretch Railways and Roadways corridors were already saturated hence in due course of time development of Inland Waterways is important for meeting the future cargo transportation demands. Waterways routes connects the far flung and remote areas where Railways & Roadways are not dominant this IWT offers connectivity to those areas definitely facilitate the economic development of rural region located along the Ganga basin.

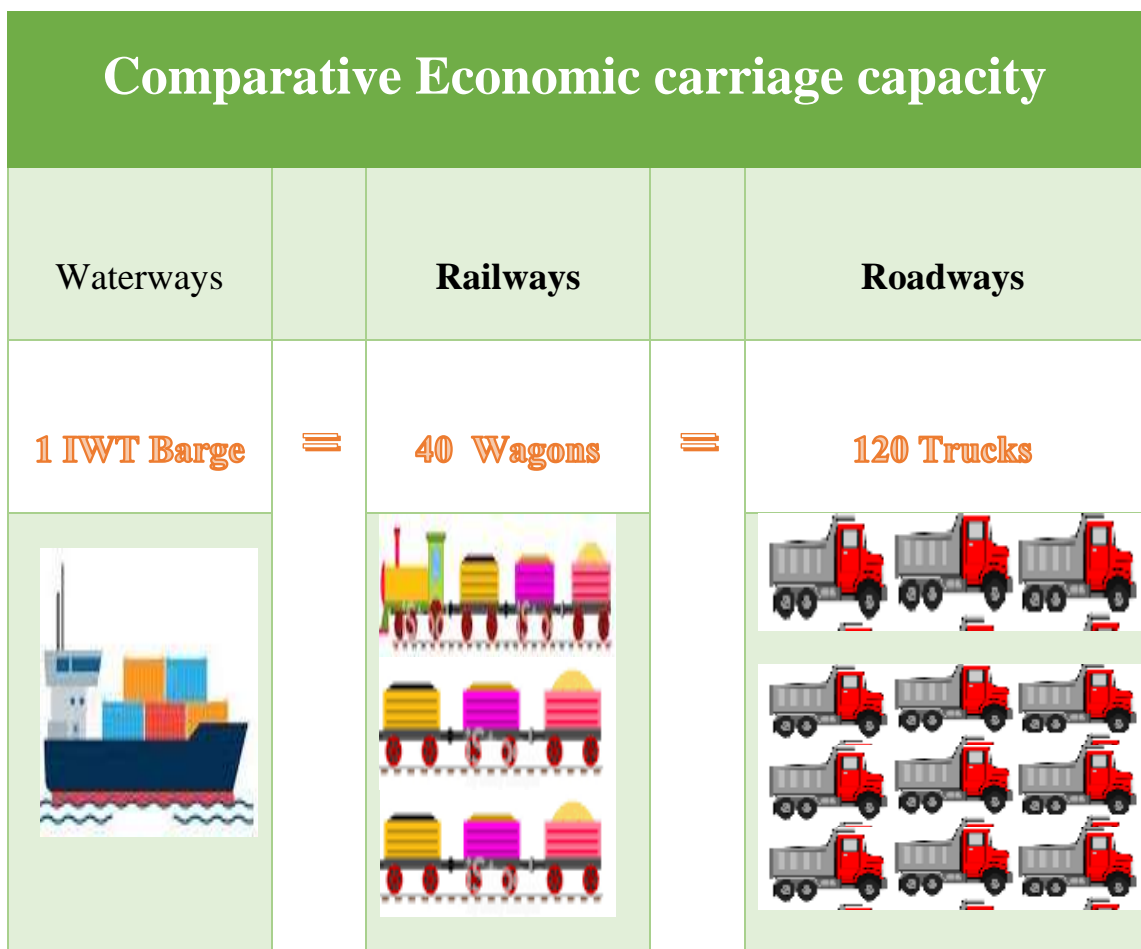
Reduction in the cost of transportation is the major benefits reap out of by setting up of Inland Water Transport (IWT) modes as per the released data of Inland Waterways Authority of India the IWT vessels has better efficiency in terms of fuel consumption while transporting cargo through route of waterway



(Fig No.6. Volumes of Cargo Transported by various transport modes with 1 litter of fuel, Source: PIB, Government of India)⁷

Land Acquisition for developing IWT transport Infrastructure is minimal as compare with Roadways, Railways, Airways and any other modes of transport. The Inland water transport offers supplementary benefits by reducing congestion on from roads and decrease turn-around time for cargo transportation which saves from getting lots in terms of damage of transit stocks, also improve efficiency of trades in the regions.

Congested roads and busy networks of railways sometimes causes fatal accidents, there is risk of health and safety hazards, hence under this stressed situation developing Inland Water Transport infrastructure accommodate overburden cargo traffic and making possibilities for meeting the future rising demand of transport also.



(Fig. No. 7. Comparative economic carriage capacity, Source: Website of Ministry of Ports, Shipping and Waterways, Govt. of India)

We can easily draw our understanding regarding economic carriage capacity of various transport modes, as we already know our Roadways and Railways are already established mode of transportation, now the thrust of country to reduce total logistics cost from GDP

⁷ IWAI, Ministry of Ports, Shipping and Waterways “Published Boucher” <https://shipmin.gov.in/division/iwt-1>

budget, reduce down the environmental pollution by decongest the existing roads and resolve frequent traffic jams issues and increasing road accidents on roadways and railways is major concern.

The carriage capacity of 1 IWT barge of 2000 DWT can easily replace 40 wagons/racks of railway and approx. 120 trucks from roadways, hence it is clear indicated that the economic carriage capacity of 1 barge of 2000 DWT has much higher than any other surface modes of transport.

In present situation where railways infrastructure is already under huge pressure and roads are congest due to increasing cargo traffic trends and now the developing country like India has very impossible type thing for creating another similar capacity of infrastructure on road & rail to meet the requirement

And the capital invest cost for creating new roadways or railways infrastructure is very huge hence under this circumstances the choice is left for developing and using our rivers as National Waterways for logistics management.

The new Inland Water Transport sector in India can be treated as the complimentary transport mode with roadways and railways, overall comparing benefits of IWT sector is much significant over any other surface modes of transport and the effective usage of National Waterways will offers huge economic cost savings for the nation in long run time.

Details of carriage capacity on various modes of surface transports⁸

Mode of Transport	Carriage Vehicle	Carriage Capacity (MT)
Roadways	Truck (Normally 10 Wheeled)	16
Railways	Rail Racks of (40 Wagons)	2200
Inland Water Transport	1 IWT Vessel	2000

(Table no. 3. Details of carriage capacity of different modes of transport, Source: Inland Waterways Authority of India and Ministry of Shipping)

Utilization of rivers water resources for transportation purposes will leads India's to achieve long term economic growth, the model shift of cargo from railways and roadways to waterways will opens greater opportunity for development of multimodal transport model for efficient handling of domestics and international logistics.

The continued economic growth has bring down the tremendous expansion of transportation sector in India it is observed that the growth in logistics sector are flowing similar trends of growth recorded in GDP of our country in past several financial years and the growth of our Inland Water Transport sector is negligible, in one hand the country like India is blessed with networks of rivers and huge coverage of coastal lines hence there is tremendous opportunity for growth in Inland water transport sector.

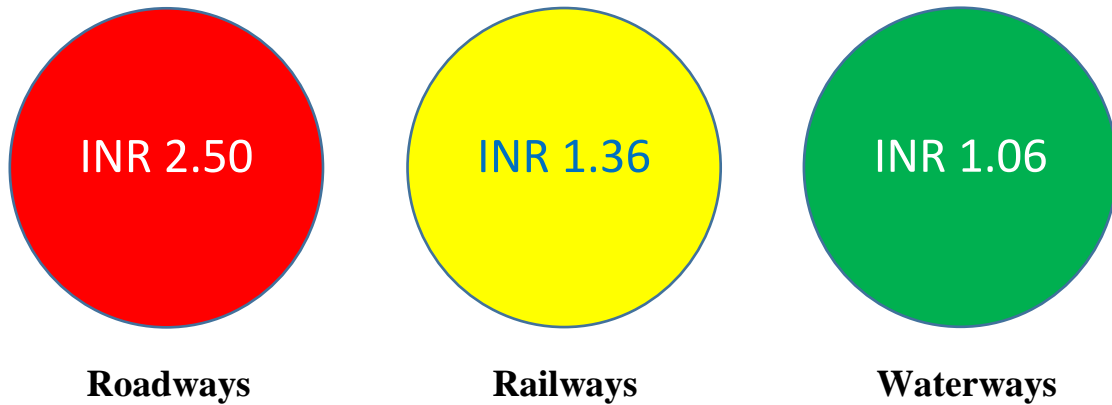
The model mix utilization of transport sector in India is highly skewed towards roadways and railways modes of transport which results to reach up to the saturation levels with increasing congestion of traffic on roadways and railways.

The model shift of cargo traffic from roadways and railways to waterways are essentially required and this initiative will also help India to improve its logistics performance index ranking rated for efficient logistics handling, another important aspects of using Inland Waterways is cost savings factors, the

⁸ IWAI, Ministry of Ports, Shipping and Waterways "Published Boucher" <https://shipmin.gov.in/division/iwt-1>

cost of transportation on waterways are approx. 50% lesser than roadways and approx. 30% lesser than railways.

COST OF TRANSPORTATION OF 1 METRIC TONS OF FREIGHT FOR 1 KILOMETRE ON⁹



(Fig No.8. Per metric tons per Kilometre cost of transportation with different modes of Transports, Data Source: Ministry of Railways and TTSS study of roadways)

1.3 Modality of Freight Transport in India

The transportation network of India is extensive in the world, being developing country India is focussing for utilization of distinct mode of transport. Presently the cargo movement on Indian roadways are very dominating as road transport offers flexibility in first mile and last mile transport but this mode of transport is highly suitable for lower haulage and for shorter distances.

Railways and Waterways transport mode is only suitable for longer distance with economic lot of haulage as this mode of transport has fixed Origin and Destination pairs and having constraint over the last mile and first mile, however the modern intermodal service and multimodal transport operations has increased the ability for this transport modes

Airways modes of transport is always suitable for very short turn-around time it is very higher cost impact and pollution creator too.

Pipeline modes of transport is only suitable of liquid and gases cargo or any suitable chemicals.

Well, the Railways, Waterways and Pipelines modes of transport are performing very effectively under certain circumstances typically the goods in high volume over longer distances are suitably effective.

Every country looking for minimising the overall transport cost to achieve the edge over competition, the price and time sensitive transport are essentially needed under dynamic market conditions, hence taking of the efficient model share of transport are required.

The Indian transport system has comprised of Roadways, Railways, Airways, National Waterways and Pipelines etc.

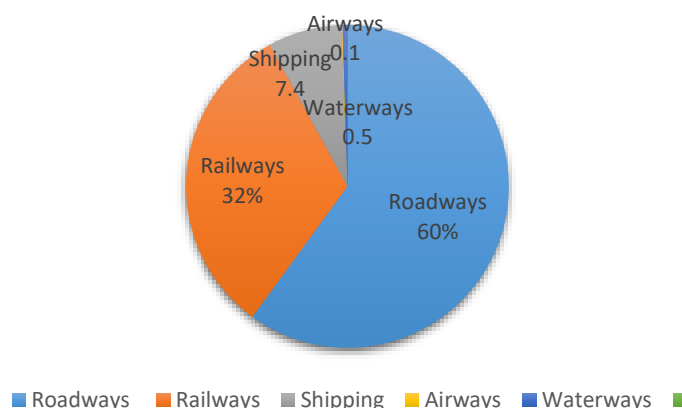
⁹ Planning Commission: TTS Study 2014

Presently the Indian Logistics market estimated value is approximate USD 130 billion in the FY 2012-2013 with CAGR of over 16% over last five years.

10

In India roadways are always dominating mode for freight transportation by accommodation of total 60% of freight traffic, the Indian Railways carries only 32.% of freight, whereas costal shipping has share of 7.4% of freight, the Airways has 0.1% share of total freight and lastly waterways only carries 0.5% of share of freight share.

Model Share of Freight Movement in % on Various Modes of Transport In India



(Fig.9. Source: IMaCs Analysis, World Bank, IWAI & JICA - Fig.9)

1.4 Utilization of IWT Sector by Various Countries

Inland Water transportation is safer, cheaper and most environmental friendly mode of transport and having potential of best utilization for transportation, various developed and developing countries are using their rivers as waterways, India is also transporting 0.5% of their total freight on waterway, the utilization of Inland shipping is neglected sector in India but rising demand of logistics and saturation of road and railways infrastructure turning the pages to utilise the river for transportation.

The specialist form various ministry has estimated that diversion of one billion – tone kilometre of cargo to Inland Water Transport mode from other modes (Road and Railways) will save the fuel cost by USD five million whereas overall total transport cost will be saved by USD nine million

If the 10% of the total India’s freight moves through IWT routes in India it can help in drastic reduction in transportation expenditures bills by INR 10,000 Corers.

Globally it was noticed that various countries are using their perineal rivers as waterways and already harnessing the potential of Inland Water Transport economies in managing of supply chain of their country.

The developed nation like USA, China, Germany are using their waterways effectively and made model shift of their significant cargo traffic on inland shipping

The countries like Netherlands and Bangladesh have already diverted their freight more than of 35% on Inland shipping (Inland Waterways) sector, unfortunately our country

¹⁰ IMaCs Analysis, World Bank, IWAI & JICA

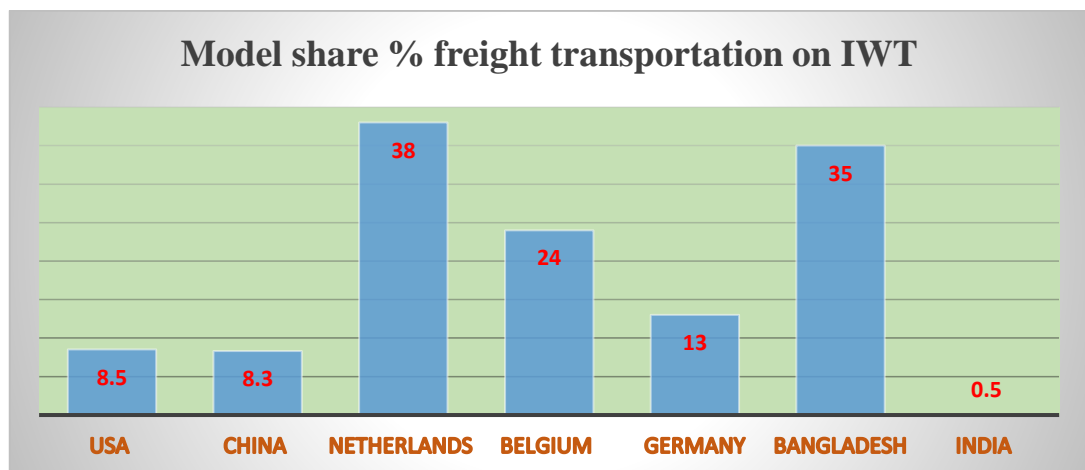
India has only able to utilise for 0.5% of total freight transportation by using National Waterways or Inland Shipping India has approximate 14,500 KM of navigable river and additionally 4,000 Km of canals can be utilised in form of waterways for transportation purposes. ¹¹

Utilization % of IWT Sector by Various Nations	
Countries	% Model Share of total freight of country transported by IWT
USA	8.5% of their total freight are transported through IWT
China	8.3% of their freight are transported through IWT routes
Netherlands	38% of their freight are moved through IWT mode
Belgium	24% of their total freight are moved with IWT
Germany	13% of their total national cargo moved on IWT sector
Bangladesh	35% share of cargo movement happened through IWT routes
India	Only 0.5% of total cargo moved through Inland Waterways

(Table No.4. Source: www.scmpro.co.in and www.indiawarehousingshow.com dated 16.02.2020)

India having 14500 Kilometres of navigable river which is enough for transshipment freight from existing mode of transport to waterways.

Undermentioned graphical representation indicates that various countries has made model share percentage of freight traffic diversion on their inland water transport, countries like USA is transporting 8.5% of their total cargo on Inland Waterways, China is transporting 8.3% of their cargo on IWT, the Germany is transporting 13% whereas Netherland is transporting 38% model share of total cargo on IWT, in fact our neighbouring country Bangladesh is transporting their 35% model share cargo on their National Waterways and presently our country India is only transporting 0.5% of model share of freight out of its total cargo.



(Fig. No.10. Data source: www.scmpro.co.in and www.indiawarehousingshow.com)

Form above graphical representation this is clear concluded that our country is not able to utilise the Inland Water Transport sector potential since long or knowingly this sector was neglected, in above table and graphs we have seen that many developing and developed nations are utilizing their natural resources in best way for the transportation and strengthening of their economy.

¹¹ Source: www.scmpro.co.in and www.indiawarehousingshow.com dated 16.02.2020

Movement of cargo on National Waterways is always maximise the economic returns as this is only the mode which is cheaper, environmentally friendly, and cost effective and most important aspect was that India is geographically best suitable for river transportation as the country has presence of vast networks of rivers which can harness the various economic gains.

Country wise analysis of waterways length and annual freight movement¹²

Countries	Total length of Inland Waterways (Kilometers)	Annual cargo movement on IWT (Million Metric Tons)	Narration
	123,000	1100	China
	42,000	210	Vietnam
	40,000	615	USA
	35,000	565	European Union
	21,000	33.32	India

(Table No.5. Data source reports of World Bank, JICA, and IWAI, Ministry of Shipping)

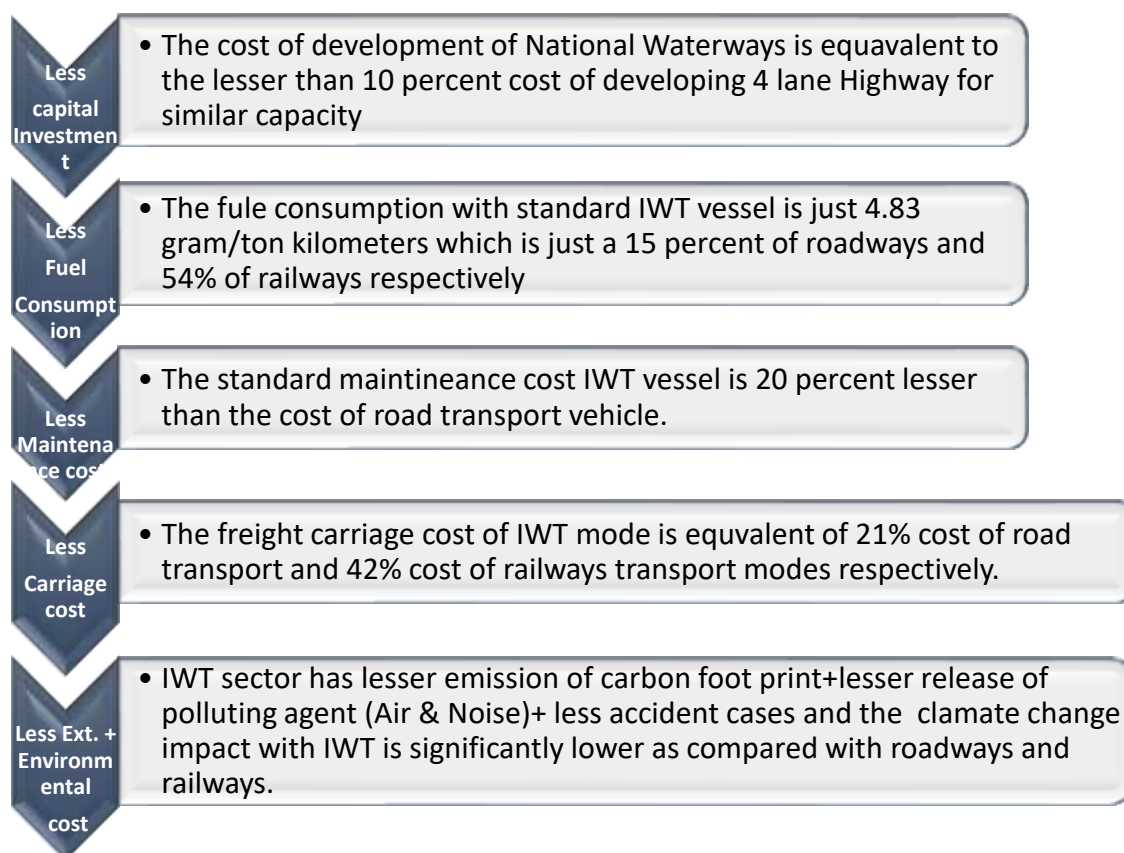
1.5 Advantages of Inland Water Transportation

India is largely benefitted by its geographical presence of more than 7500 kilometres of coastal waterways and 111 rivers networks in form of national waterways for 14,500 km of navigation length and the country accounted as largest merchant shipping fleet among all developing nations but unfortunately the IWT sector was neglected since after

¹² Reports of World Bank, JICA, and IWAI, Ministry of Shipping.

independence and now the present utilization level of Inland waterways in India is highly underutilised as compared with any other nation.

The advantages of Inland Water Transportation sector are as follows:



(Fig No.11. Advantages of Inland Water Transportation)¹³

1.6 Comparative economic benefits of different modes of Transports. Its proven fact that IWT mode of transport is always economical, cost efficient, environmental friendly and reliable transport options for shipper, following parameters of transport like fuel efficiency, carriage capacity and pollution are found very less with IWT mode of transport as compared with any other surface modes of transport i.e railways or roadways.

Parameters	Inland Waterways	Railways	Roadways
Fuel efficiency: 1 litter of fuel can move how much freight (ton-km)	105 Tons	85 Tons	24 Tons
Equivalent single unit carrying capacity	1 Barge	40 Railways wagons	120 Trucks
Pollution	Low	Medium	High

(Table No.6. Source: Comparative economic benefits of different modes of transport, Ministry of Ports, Shipping and Waterways, Government of India)

¹³ Research Analysis – Report on Comparative economic benefits of different modes of transport, Ministry of Ports, Shipping and Waterways, Government of India

1.7 Jal Marg Vikas Project Initiative for Development of NW-1 for Navigation and Transportation Purposes:

The Government of India has announced in their budget speech of 2014-2015 for development of Indian River for commercially navigability of cargo ships for transportation of freight and passenger's movement, the Jal Marg Vikas Project envisage for the development of waterways on river Ganges from Haldia to Varanasi and extended up to the Prayagraj (Allahabad)

The Jal Marg Vikas Project aims for development of fairway with three-meter depth on the river and develop fairway for navigation, creation of multimodal terminal (river port), strengthening of river depth for navigation and installation of river information system for vessel real time monitoring, river training and river conservancy works are proposed to be done by March 2023. ¹⁴

This project outcome is to strengthen national waterway-1 to ply inland vessel up to the capacity of 1500-2000 DWT barges, the project will provide opportunities for private sector participation and opens the doors of economic investments in promoting trade and commerce along Ganga basin from Varanasi to Haldia.

The infrastructure development with start operations of National Waterways 1 provide alternative transport options which is most environmental friendly modes of transport and also reduces cost of transportation of commodity, additionally it helps for reducing traffic congestion on roads and railways.

The development of mammoth infrastructure like Multimodal Terminal, Intermodal Terminal, Roll on – Roll off facilities, ferry services, navigational aids, dredging, river training, designing of standard vessels, development of ferry transport, development of river information system, Bank protection and bundling, channel marking and river conservancy works etc. This project gives greater impetus on socio-economic development along the hinterlands of national waterway 1

The investments made by govt. of India under flagship Jal Marg Vikas Project initiatives approved by cabinet committee of economic affairs on 3rd January 2018 for implementation of this project on river Ganga

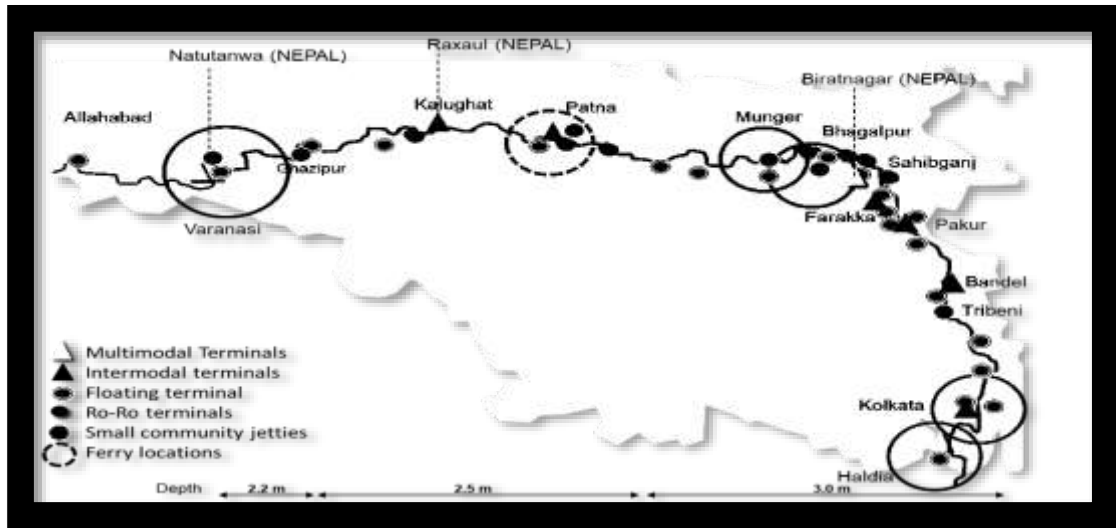
In present condition the project of INR 2000 cores is already on ground and major investments are made in the following development works.

- Construction of Multimodal Terminal at Varanasi in Uttar Pradesh state costing of INR 169.7 Crs
- Construction of Multimodal Terminal at Sahibganj in Jharkhand state costing of INR 280.90 Crs.
- Construction of Multimodal Terminal at Haldia in West Bengal State costing of INR 517.36 Crs
- A construction of New Navigational Lock Gate – A ship lift project is under implementation near Farakka Barrage area in West Bengal costing of INR 359.19 Crs.

¹⁴ [Home | Jal marg vikas Project | Government of India \(jmvp.nic.in\)](http://Home | Jal marg vikas Project | Government of India (jmvp.nic.in))

- The other projects like Dredging, Channel Maintenance, Bundling, river cores corrections, river training, construction of shallow draft vessel, construction of Intermodal terminals, Introduction of LNG vessels etc.

Apart from the above works the works like construction of Intermodal terminal at Ghazipur, Intermodal terminal at Kalughat Bihar, Ferry Services Projects, Ro-Ro



(Fig No.12. Overview of Jal Marg Vikas Project for development of IWT Infrastructure on NW-1)

Terminals, River Information system, construction of freight village, small community jetty, railways connectivity to the respective terminals etc. were planned in near future.

For efficient navigability of IWT vessels along NW-1, detailed strategy planned for maintaining least assured depth in Ganga under Jal Marg Vikas Project initiative, the strategic locations are identified where siltation and shoal formation frequently takes place and hinders navigation channel in the river.



(Fig. No.13. View of dredging operation in Progress along NW-1)

The deployment of dredgers and survey vessels requires potential dredging plan and methodology, the proper removal of siltation and shoals are required to maintain 45-meter-wide navigation channel in the river.

The dredged material is disposed with help of pipeline within the flowing water by ensuring that position of dump avoid martial to way back comes in the main channel again.

The Jal Marg Vikas Project has envisaged plan for creating targeted LAD and 45-meter-wide navigation channel, dredging efforts are combined with river training, river bend corrections and bandalling works etc.

Inland Waterways Authority of India putting substantial efforts in removing of siltation and shoals from main navigation channel and regularly monitor all dredging activities.

Government is intended to develop least available depth (LAD) of 3meter, 2.5 meter and 2.2 meter on various stretches on National Waterways – 1 between Varanasi – Haldia for smooth navigation of Inland vessels of 1500 -2000 DWT capacity.

The dredging works are also planned along with Bandalling in critical stretches of the river to make navigable for all season, the silt deposited in the river bed are removed in order to increase depth for efficient navigation of IWT vessels.

It was observed that the water level flows in river Ganga is started getting lower from October onwards and getting critical during late November, hence the requirement of sufficient LAD is expected during that time secondly after flood season the river is meandering hence the dredging works are required for making approach channel and ensuring the sufficient LAD for navigation in Ganga.

Stretch of NW-1 ¹⁵	Length	Targeted LAD
HALDIA – BARH	1050 Km	LAD 3.00 Meter
BARH – GHAZIPUR	280 Km	LAD 2.50 Meter
GHAZIPUR – VARANASI	130 Km	LAD 2.20 Meter

(Table No.7. Source: Dredging Organization Plan, IWAI, Ministry of Shipping)

National waterway 1 i.e NW-1, is the longest river routes in India which is navigable for transportation of cargo, the total of 1620 KM from Prayagraj (Allahabad) to Haldia (up to Sagar Island) the river Ganga –Bhagirathi – Hooghly river system is declared as National Waterway – 1

The river system of Ganga-Bhagirathi-Hooghly called National Waterway 1 passes through the Indian states of Uttar Pradesh, Bihar, Jharkhand and West Bengal, the river has potential to serve the major cities located long its basin such as Haldia, Howrah, Kolkata, Bhagalpur, Patna, Ghazipur, Varanasi and Allahabad. The NW-1 has significance of catering needs four states population of India and supports to the industrial clusters and several industries needs along the hinterlands of Ganga basin.

The National Waterways-1 hinterlands areas of rail networks and road corridors are already saturated, majority of populations of this area is affected due to traffic congestion issues and leads to create lots of pollutions due to emission of carbon footprint in the region.

The development of New Railway lines and Road networks are very costlier factors for the developing countries like India and in these four states the NW-1 hinterland is the

¹⁵ Dredging Organization Plan, IWAI, Ministry of Shipping, INLAND WATER TRANSPORT | Ministry of Ports, Shipping and Waterways (shipmin.gov.in)

habitat of millions of populations. Hence the options left with Indian Government to utilise its negated sector for development i.e Inland Water Transport Sector, India having fortune geographic conditions the river Ganga is having the presence of 1620 KM Inland and caters four highly populated states. The development of National Waterway 1 from Allahabad (Prayagraj) to Haldia helps in decongesting traffic, saves time, fuel and helps to reduce the logistics cost too. The Inland Water Transport mode is suitable for the various types of cargo handling and this sector manages well in effectively handling of Bulk cargo, Hazardous Goods, and Over-Dimensional cargo etc.

Presently Haldia to Varanasi stretch of river is under development with technical and financial assistance from World Bank support, Govt. of India is investing estimated cost of approximate INR 5,369.18 Cores for development of National Waterway 1.

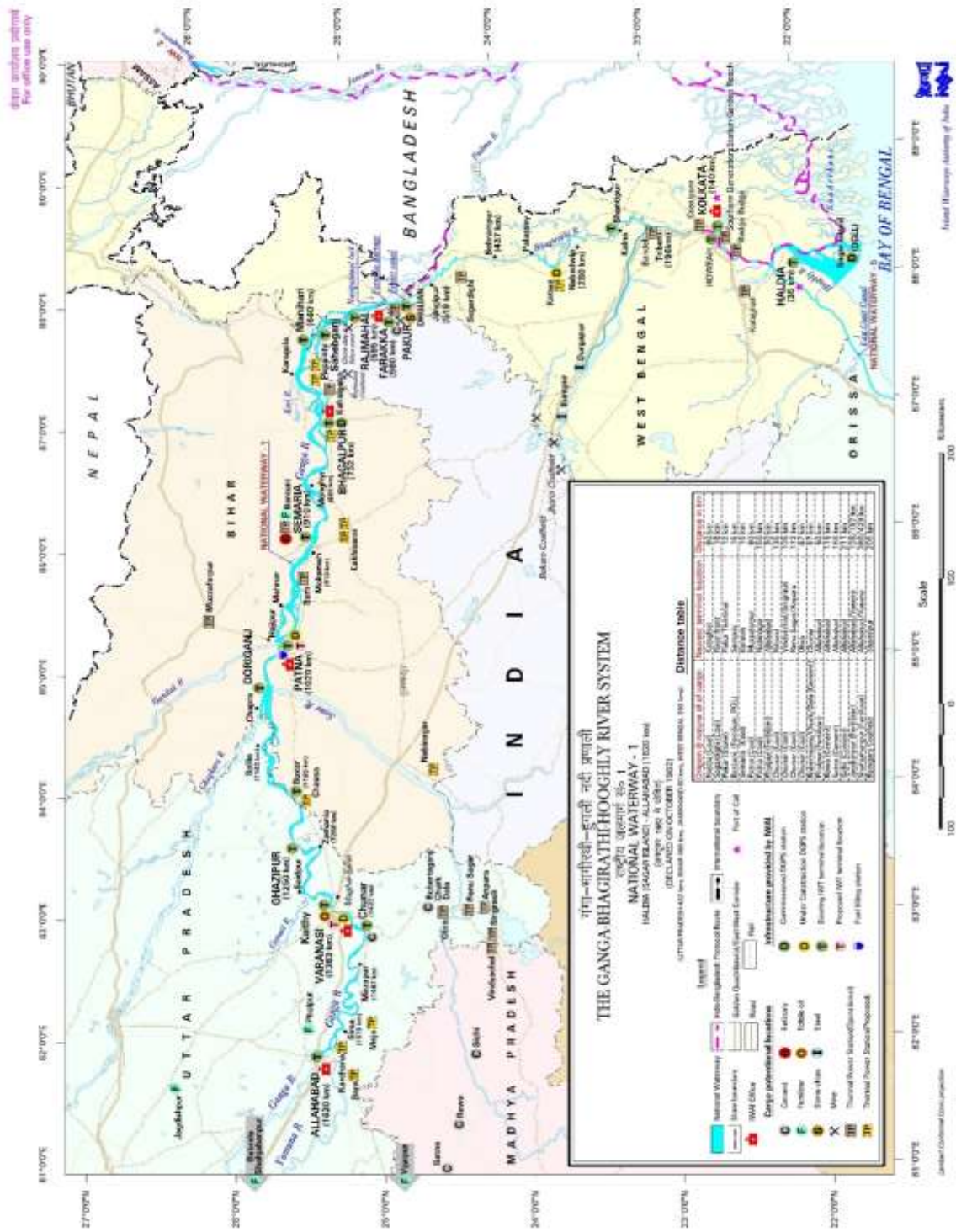
The cost of project was shared in between World Bank on 50:50 ratio, the project is named as “Jal Marg Vikas Project” under this project it is proposed for development of modern river port for handling of cargo and passenger mobility.

JMVP aims for promoting the alternative modes of transport other than existing modes, secondly IWT is cost effective, safer and environmental modes of transport compared to any other modes of transport facility

The development of waterways in these regions will impact various communities living along the hinterlands such as fisher man community, local country boat operators and farmers living along the Ganga.

Here is the district wise area is listed which located along the banks of river Ganges, mostly the populations who lives within the hinterland has larger community of fisherman and boatman who is fully depend on the water resources of river Ganga

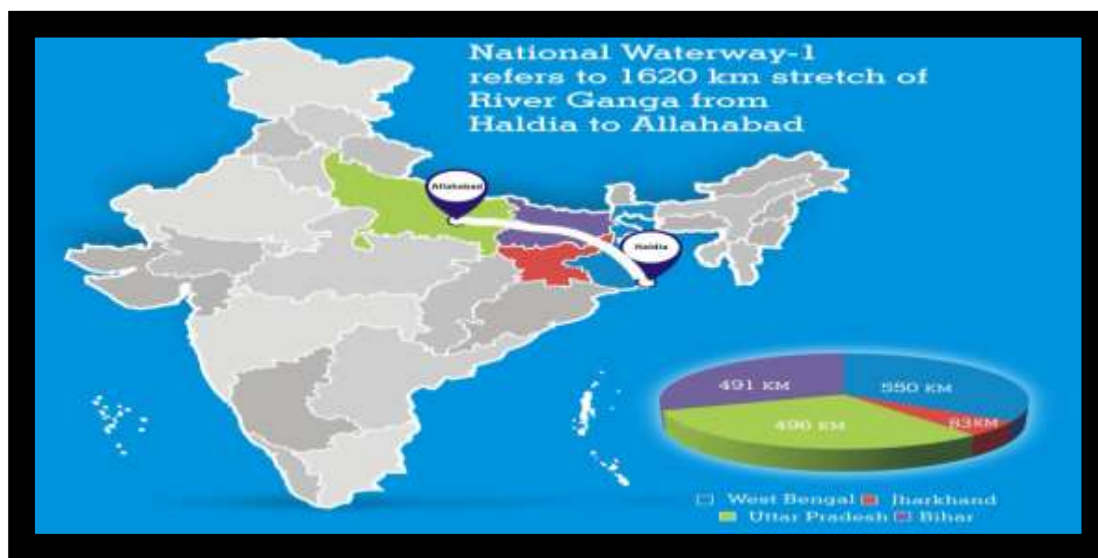
National Waterway 1 catchment area lies in the four Indian states and offers economic benefit to populations of Uttar Pradesh, Bihar, Jharkhand and West Bengal.



(Fig No.14. Map of National Waterway-1. Source: Inland Waterways Authority of India, Ministry of Ports, Shipping and Waterway, Government of India)¹⁶

¹⁶ <https://iwai.nic.in/waterways/national-waterways/national-waterways-1?id=2523>
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State wise Navigable length of National Waterways 1 from Allahabad to Haldia



(Fig No.15. NW-1- State wise length, data source: Insightonline.com, dated: 07.04.2019)¹⁷

List of the following district Impacted by development of National Waterway

States	U.P	Bihar	Jharkhand	West Bengal
District located along the hinterland of river Ganga.	Allahabad	Begusarai	Sahibganj,	Hooghly
	Mirzapur	Bhagalpur		Howrah
	St Ravidas Nagar	Bhojpur		Malda
	(Bhadohi)	Buxar		Murshidabad
	VARANASI	Katihar		Nadia
	Chandauli	Khagaria		Purba
	Ghazipur	Lakhisarai		Bardhamani
	Ballia	Munger		Sout 24
		Patna		Parganas
		Samastipur		Haldia
	Saran			
	Vaishali			
Distance	496 km	491 km	83 km	550 km

(Table No. 8. List of districts along NW-1, Source: Internet Research)

Sustainable development of green transportation is the main aim of Jal Marg Vikas Project, the strategic design were made to avoid and reduce the environmental damage, and aligned the Inland Water Transport in India on the principal of “*Working along with Nature*”

The total influential areas of river Ganaga spread in 57 districts of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal cumulatively accounting for 107397 Kilometres and approximate 200 million of populations are living.

¹⁷ Article published in Insightonline.com, dated: 07.04.2019

Many potential industries, business clusters, religious, educational and healthcare institutions are established along the hinterland of the river.

1.8 Macroscopic View on Economic Investments Made for Augmenting National Waterways-1

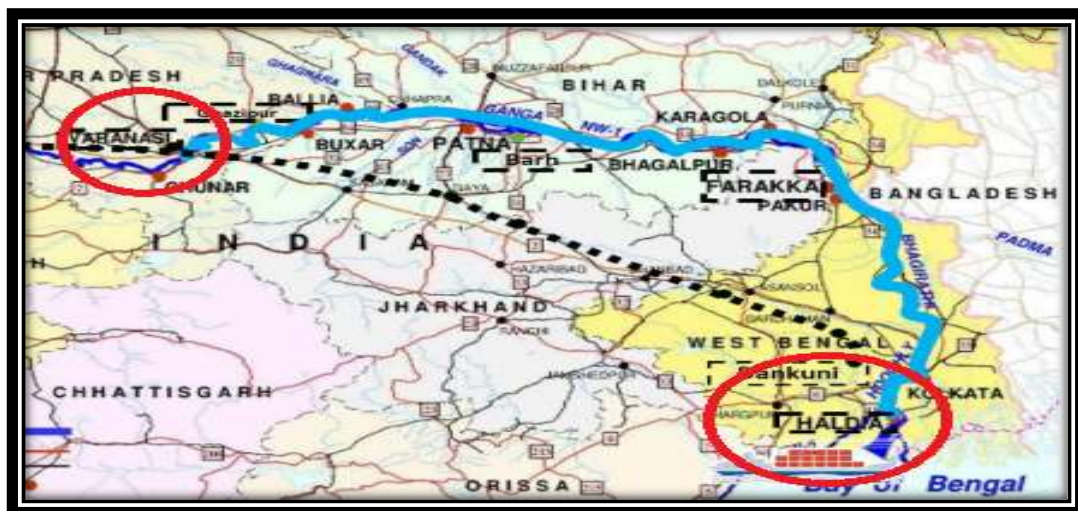
The future transport systems of India focus for movement of the cargo along the coastal areas and Inland Waterways, the country has achieved considerable economic growth in past few decades which results for congestion on roadways and overburden on railways networks. Hence the option is left for development of Inland Water Transport sector is only remedial measures left before the government.

India is blessed with 7551 km of costal lines and about 14500 km of navigable inland waterways out of which only 4,503 km of waterways have moved the cargo which only account for 0.5% of freight share only.

National Waterway 1:

The development of national waterways 1 (Ganga-Bhagirathi-Hooghly) river system between Allahabad (Prayagraj) to Haldia 1620 km is planned to make it operational hence the developmental works for improvement of navigable and allied infrastructure are in progress

River Ganga is important constituent for economic development of the nation and recognising its multipurpose role, the river stretch of 1620 km from Allahabad to Haldia passes through various states such as Uttar Pradesh, Bihar, Jharkhand and West Bengal and these catchment area falls under the high density traffic corridors between Delhi to Kolkata.



(Fig. No.16. Catchment area of NW 1 under Jal Marg Vikas Project, Source: Google research 15.09.2019)¹⁸

1.8.1 Construction of IWT Multimodal Terminal Varanasi, Uttar Pradesh:-

Varanasi is strategically located on focal point on national logistics chain because the 1st phase of Eastern Dedicated Corridors of Indian railways project is destination to the Varanasi initially and NH2 & NH7 is also passing through MMT Varanasi hinterland

¹⁸ Google research 15.09.2019

which is the part of golden quadrilateral road hence this location has strategic significance on NW-1

MMT Varanasi is critical for offering Multimodal connectivity between rail, road and waterways and creating the best ecosystem for logistics transshipments in eastern region of Uttar Pradesh.

Highlights of MMT Varanasi

- Project Cost: INR 170 Cr.
- Land Area : 5 hectare
- Capacity: 0.5MTPA
- Jetty type: Multi-cargo & Floating Cargo
- Major Commodity Identified : Construction Material, Containers, Breakbulk, Food Grain, Coal, Stone Chips, Fertilizer, Cement, Fly Ash etc.



(Fig.no. 17 View of IWT Multimodal Terminal Varanasi)

1.8.2 Construction of IWT Multimodal Terminal Sahibganj, Jharkhand: -

Jharkhand state has abundance of minerals and natural resources like Coal, Stone Chips, Sand, Fertilizer, Sugar, fly ash, containers, cement, agricultural produce and other commodities etc. the development of Inland Water Multimodal Terminal at Sahibganj, Jharkhand will opens the window for establishment of various industries and also provide the access of cargo transportation to the various part of the world through integration of river and sea routes shipping activities.

The MMT Sahibganj will play critical role in transportation of domestic coal from Pakur and Rajmahal to the various thermal power plants located along the National Waterways 1, this terminal will also help to enhance the cargo transportation of Nepal bound cargo and strengthened the relationship in between two countries.

Highlights of MMT Sahibganj:

- Project Cost: INR 280 Cr.
- Land Area: 100 hectare
- Capacity: 2.24 MTPA
- Jetty type: Coal, Stone Chips, and Other Cargo
- Major Commodity Identified: Construction Material, Containers, Breakbulk, Food Grain, Coal, Stone Chips, Fertilizer, Cement, Fly Ash etc.



(Fig.No.18. View of IWT Multimodal Terminal Sahibganj)

1.8.3 Construction of IWT Multimodal Terminal Haldia, West Bengal:

Haldia Multi Model Terminal is the gateway of National Waterway 1, National Waterway 2, Coastal and Sea routes, it has vital role in the transshipment of cargo for upstream up to Varanasi MMT.

Presently Haldia MMT is under construction, post the development it will become robust ecosystem of logistics and supply chain in the country, the development of terminal takes place on Hugli River at Haldia in Purba Medinipur district of West Bengal.

Latitude of MMT Haldia: 22. 03' 30'' North and Longitude 88. 8' 40''

Highlights of MMT Haldia:

- Project Cost: INR 517 Cr.
- Land Area: 40 hectares
- Capacity: 2.18 MTPA
- Jetty type: Fly Ash & Multi-Cargo
- Major Commodity Identified: Fly Ash, Fertilizer, Natural Aggregates, Containers, Petroleum Products, Oils and other commodities etc.



(Fig.no.19. View of IWT Multimodal Terminal Haldia)

The Haldia terminal has connectivity with National Highway network, the MMT Haldia is located around 6km from NH41 and NH6 is the part of Golden Quadrilateral which connects Haldia port to Kolaghat and the Kolaghat is connected with Odisha, Jharkhnad, Kharagpur, Bankura, Purlia and Durgapur etc.

1.8.4 Construction of Navigational Lock Gate, Farakka, West Bengal:

Farakka Navigational lock gate is strategic asset is built along National Waterways 1, the navigational lock gate is the facility which used to uplift or lower the vessel according to the river stream, the Farakka barrage was constructed on the Ganga to divert the flow of water in Bhagirathi Canal and the water or river Ganga falls in Hooghly, the Navigational lock gate is essentially required to lift the ship for navigation into the Bhagirathi Canal and vice-versa. Jal Marg Vikas Project is constructing the New Navigational Lock Gate which enhance navigation operational efficiency of IWT Vessels on National Waterway 1.

The Farakka Barrage and Farraka Old Navigational Lock Gate was operational since 1978 and this lock gate have some technical issues and in order to modernized this old lock gate will take the approximate time of 1 year and the efficiency will also may not up to the mark hence the Jal Marg Vikas Project has taken initiative to build modern lock gate with advanced technical specifications, this infrastructure is state of art features like electro hydraulic operations of Mitre Gates and Radial gates fitted along the culverts and all operations were controlled from one control rooms only.

The old Farakka lock gate is takes approximate 2-3 Hrs of time in passing of the vessel from Upstream to Downstream or Vice Versa a, whereas the New Navigational Lock Gate have higher efficiency the vessel can pass within the 38 minutes of record time.

If the movement of vessel followed by movement of vessel in reverse directions or passing of the two vessels in opposite directions at same time the New Navigational Lock Gate operational timing is reduced up to the 23 minutes only.

Highlights of Farakka New Navigational Lock Gate:

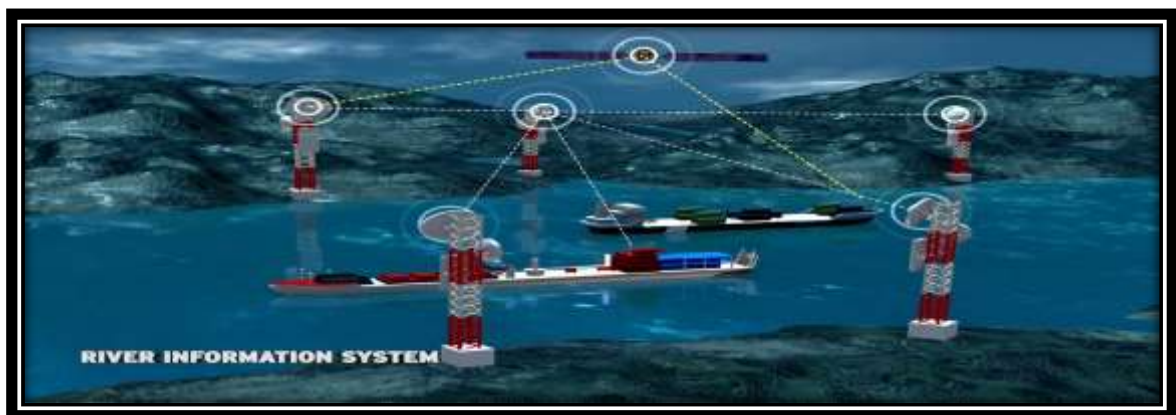
- *Project Cost: 359 Cr.*
- *Efficiency in time of operation of lock gate is 38 Minutes*
- *Land Area: 15 hectare approx.*
- *Length of Lock Gate: 179M*
- *Width of Lock Gate:26 M*
- *Average Depth 14 M*



(Fig. No.20. View of Old Navigational Lock Gate, Farakka, source: IWAI official Tweet on 29.11.2.19)¹⁹

1.8.5 Development of Digital Global Positioning & River Information System on NW-1 for Safe Navigation of Inland Vessels:

River Information System (RIS) is the digital real on time monitoring of National Waterway 1, this IT based next generation information system will help technologically in management of vessel traffic along NW-1, and this system is built along with combination of tracking and recording of metrological data together which helps in optimization of Inland transport



(Fig. No.21. RIS Developed along NW-1, Source: Tweeter post from Ministry of Shipping, Govt. of India, dated 07.02.2019)

The system will be installed in the Inland Vessels and this enables for real time exchange of electronic data transfer from mobile vessel to the DGPS stations located along the NW-1 hinterlands, through this real time based exchange of information system will helps for ensuring save navigation, locate current position of vessel, monitor the river flow, flood,

¹⁹ IWAI official Tweet on 29.11.2.19

water discharge, weather conditions for safe navigation of Inland Vessels and also helps in managing the traffic of vessels along the various river ports.



(Fig No.22. View of DGPS & River Information Stations Installed along NW-1)



(Fig No.23. View of RIS+DGPS Equipment & real-time Metrological Monitoring of National Waterway 1)²⁰

1.8.6 Plan for construction of other Important Asset on National Waterway 1

Roll On – Roll Off Services:

Under initiative of Jal Marg Vikas Project various key marine infrastructure are planned to develop along national waterway 1 hinterland, Roll On-Roll Off + Passenger Ferry Services + Ro Pax Services along the waterways are required to cut down excess movement of trucks on roadways routes for crossing Ganga, this services is like a boon for the community living along river banks of National Waterway 1, the population of this region will enjoy infrastructural facility located on the both sides of the river bank. The following Ro-Ro terminals are listed below which are planned for development along National Waterway 1

²⁰ Photograph of IWAI RIS & DGPS Station installed at Varanasi.

- i. Raj Mahal – Manikchak
(Jharkhand – West Bengal)
- ii. Bakhtiyarpur – Hasanpur
(Bihar)
- iii. Kahalgaon – Teentanga
(Bihar)
- iv. Buxar – Saraikota (Bihar –
Uttar Pradesh)
- v. Samdaghat – Manihari
(Jharkhand – Bihar)



(Fig. No.24. View of Ro-Ro Operations along NW-1)

1.8.7 Development of Ferry Services:

The development of ferry services along NW-1 hinterland will benefitted to the all travellers and populations who crosses river Ganga for fulfilment of their needs, the ferry services boost the passenger transport along the Ganga the various locations have identified for development of Ro-Pax services and ferry services, Ministry of shipping has planned for establishing the modern water transport system along the major cities located along the hinterland of river Ganga, the following city has been planned for development of Ferry services on priority within initiative of Jal Marg Viaks Project following cities are given priority for development of ferry services.

Kolkata, Haldia, Munger, Bhagalpur, Patna and Varanasi etc.



(Fig. No. 25. View of Ferry Services Operations along National Waterway 1)

1.8.8 Ship Repair & Maintenance Facility:

Government has enforced various efforts for development of marine transportation in the country and many waterways in the country are under development phase under such scenario in future there is the probability of rising numbers of ships who ply along the proposed National Waterways, therefore for ensuring regulatory and navigational safety norms the technologically advanced ship repair and maintenance facility required



(Fig. No.26. View of Ship Repair Facility)

Presently in India the ship repair facility are majorly located along the western and southern coastal regions, on National Waterways 1 there are countable number of ship repair dock are available and their infrastructure ship repair yard is also very old, the National Waterways 1 are targetting to raise traffic in coming years hence there are more number of vessels will be moved, therefore the ship repair facility are essentially required for regular maintenance service and repairs of those vessels. The Jal Marg Vikas Project has planned for the construction of Ship Repair facility for dry docking of IWT vessels and facilitate the vessel operator for repair and maintenance.

1.8.9 Fuel Bunkering Stations:

Fuel Bunkering facility is one of the most important strategic asset required for uptake of Jal Marg Vikas Project objective on NW-1, the proposed fuel stations needed to refill fuel in the vessels who ply on National Waterway 1, and Ministry of Shipping has planned to use alternative fuel LNG options for development of efficient and environmental friendly waterways transport infrastructure.

The IWT barges operated with use of LNG fuel are already designed and the IWAI has planned for switching of IWT operations from traditional fuel to LNG fuel and development initiative of LNG fuel stations are already under taken on priority basis.

IWAI will facilitate to the Vessels operators along NW-1 for making availability of LNG fuel for that storage infrastructure for LNG bunkering are planned and the Ganga Action Initiative objective also aims to reducing the pollution, the use of LNG fuel in IWT vessels are re-enforcing the objective by using green fuel.



(Fig No.27. View of Fuel Bunkering Station along NW-1)

1.8.10 Development of Freight Village & Logistics Hub along the NW1: - ²¹

Inland Waterways Authority of India is the implementing agency for development of National Waterways in the country, Jal Marg Vikas Project is already under the implementation phase on National Waterways 1 (Ganga-Bhagirathi-Hooghly) river system.

A Freight Village is a specialized industrial estate which attracts companies that require logistics services and which can cluster to improve their competitiveness. Freight Villages offer complete and organized services such as utilities and access to Government services needed to improve 'ease of doing businesses. Ordinarily, Freight Villages also include multimodal terminals (IWT, Road and Railways) which facilitates for integration in

²¹ <https://timesofindia.indiatimes.com/india/varanasi-to-get-indias-1st-freight-village/articleshow/58935963.cms>

between different modes of transport – this offers choice for selection of best possible cost and time effective transport solutions to the shippers

On another hand Jal Marg Vikas Project aims to increase traffic along National Waterway 1 secondly the development of freight village near MMT Varanasi and MMT Sahibganj increases significant use of National Waterways.

In order to make Waterways the preferred mode of transportation, the necessary steps for building logistics infrastructure along NW-1 are needed, the model mix of geographic wide presence of Railways and Roadways networks become skewed as compare over the waterways networks, the management of logistics with IWT matter is are very much debatable issues among shippers, moreover the advantages of opportunity cost of IWT transportation and wider rural areas coverage range are with National Waterways can't be ignored.

1.8.11 Development of Freight Village Project near Varanasi MMT

The development of freight village is proposed by the Ministry of Shipping planned to be established near Multimodal Terminal Varanasi, main objective for creating this freight village is to create the logistics hub near the IWT terminal Varanasi where various logistics companies, shippers, operators may established their units for cargo aggregation, processing of raw materials and packaging of raw materials etc. and transport their goods to the various OD pairs as per their desired modes of transport.

As we know that various Origin and Destination pairs along the IWT routes become unviable whenever we compared with Roadways and Railways, all economic development and necessary economic infrastructure were developed along the Roadways and Railways networks thus majority of the O-D pairs are suitable with roadways and railways in present scenario, whereas the Waterways was neglected since longer time and become the lost economic opportunity for India, hence development of Special Economic Zone in the form of Logistics Parks of Freight Village near Varanasi MMT will helps in boost the utilization of National Waterways for cargo transportation and the suitable O-D will be formed, the cargo will be originated and desitinated along the NWs hinterland, the economic viability automatically revile out.

Varanasi MMT is located at strategic location on NW-1 where the Eastern Dedicated Freight Corridor is passing from Delhi to Kolkata and First phase of EDFC is destined at Varanasi and construction for second phase of EDFC will take longer time and expected for completion by FY 2050, whereas MMT Varanasi is already Inaugurated Hon'ble Prime Minister of India on 12.11.2018 and dedicated to the Nation, the proposed freight village along the O-D pairs of National Waterways increases multimodal transportation efficiency by reducing first and last mile connectivity cost up to the most extent, by development of Multimodal Terminal with associated logistics park attracts interested shipper together at one place where manufacturing & trading companies are under at one roof, the allotment of land will be made on lease so that the transportation and manufacturing will become organised along National Waterways.

The Varanasi MMT lies within the vicinity of NH2 and NH7 which is the part of Golden Quadrilateral roads connecting all major metro cities of India and the East and North division of Indian Railways is also merges here at Varanasi on equal distance from Eastern to Western part of India, this makes Varanasi MMT on unique geographical location and become important aspects for making Logistics hub in the country.

Presently at Varanasi region there is lacks of organised logistics facility and development of IWT Multimodal Terminal here may increases cargo traffic movement, the combined synchronised strategy and formation of joint operation modality with JMVP, EDFC and NHAH will boost for up taking productive logistics neighbourhood and enhance the ease of doing business.



(Fig. No.28. Model Plan for development of Freight Village at Varanasi, Source of Image: www.google.com dt.05.04.2018)²²

1.8.12 Freight Village Project at Sahibganj, Jharkhand: -

Jharkhand state is mineral based state and has approximate 40.10 percent of mineral reserve of the country, major minerals resource are found here like Coal, uranium, mica, bauxite, granite, gold, silver, magnetite, dolomite, fireclay, feldspar, iron and copper etc. apart from the mineral Jharkhand is the producer of good quantity of agriculture commodity and generate sizable amount of cargo loads, the Ministry of Shipping has identified Sahibganj area for development Freight Village near MMT Sahibganj to aggregate cargo for transportation with IWT routes. MMT Sahibganj is already inaugurated by present government on 12.09.2019.

The development works for Integrated Cluster & Logistics Park or Freight village project at Sahibganj may enhances logistics performance of Jharkhand state and the seamless IWT connectivity along with Rail and Road options for first mile or last mile, this logistics model mix will add sugar in the coffee of shipper or logistics operator of Jharkhand state.

The freight village adjoining to the MMT Sahibganj will boost the regional distribution and aggregation of cargo and attract potential investors and makes the possibilities for establishing mega Industries along the river Ganga, as IWT routes enhances logistics efficiency for transporting cargo through National Waterways

Sahibganj MMT is strategic assets developed along the Ganga due to regional availability of mineral and natural resources therefore the demand of freight village there, logistics park will attract investments from various industries who usages mineral as their raw material and this industry can easily facilitate their transport of cargo by using National Waterways. The freight village has provision of roadways and railways connectivity hence the shipper has always choice for choosing best mode of transport as per their

²² www.google.com dt.05.04.2018

requirements, the development of freight village along with IWT Multimodal terminal Sahibganj will optimize the transportation efficiency and promote the ease of doing business.

Some of the commodity which are presently transporting form Haldia to Nepal and Sahibganj to Bangladesh can be easily become custom bonded form here at Sahibganj MMT and Freight Village, this development help to reduce the unnecessary handling of First mile and Last Mile connectivity cost and lead to reduce transportation cost, the IWT sector is the most economical mode of handling logistics, the Freight village project will built strategic O-D pairs along the National Waterway 1.

The development of freight village at Sahibganj and Varanasi are the strategic investment by government in developing the economy of Ganga and these asset attract investors for setting up of their factories, processing plant, storage facility, warehouses, distribution and packaging hubs etc. along the National Waterway 1, the Freight village project will enhance development of IWT based logistics O-D pairs and boost the economy along the hinterland of river Ganges, in near future various production and consumptions centres may be developed along the NW1 hinterland, the catchment area of Ganga plans are very densely populated and IWT sector will help in serving the roots of major consumption and production sites.

The Freight village Sahibganj helps to build economic eco-system along the National Waterway1, this initiative helps in development of IWT logistics sector market in India, for harnessing full potential of IWT sector the freight village will be treated as an essence for cost savings economics in terms of reduction in First Mile, Last Mile, Warehousing and Distributions etc. for setting up of the industries along the NW-1 the investor always keeping in mind to establish O-D pairs for distribution coverage associated with NW-1 hinterland

In future there is the possibility of setting up of many industries along the Ganga-Bhagirathi-Hooghly River system, the hinterland will result in creation of sizable economics of production and consumption facility along NW-1 and save the huge logistics expenditure of the country.

1.9 Important National Waterways of India ²³

Inland Water Transport are the potential mode of transport sector in India, the regulatory bodies of Indian Government have taken up the initiatives of infrastructure development, various regulations were framed for declaration of various Indian rivers as National Waterways, total 111 rivers are declared as national waterway in 2016 and Inland Waterways Authority of India is the nodal agency who develops navigable Infrastructure along the National Waterway 1.

Following five National Waterways are prioritized by the Government of India for augmentation and utilising river for cargo transportation:

- **National Waterways – 1:** Ganga-Bhagirathi-Hooghly River system from Allahabad, Uttar Pradesh to Haldia, West Bengal total length of 1620 Km.
- **National Waterways – 2:** River Brahmaputra from Dhubri to Sadiya in Assam the total navigation length of 981 Km.

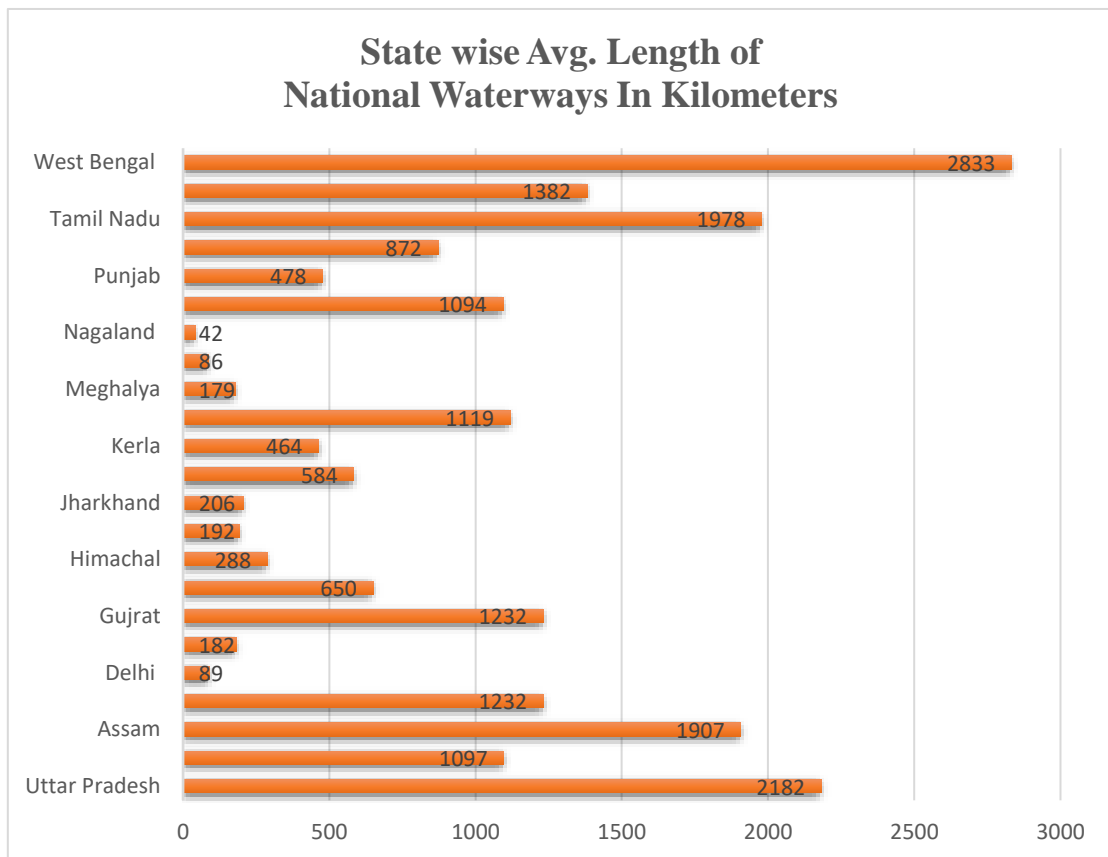
²³ Inland Waterways Authority of India, Government of India (iwai.nic.in)

- **National Waterways – 3:** which includes West Coast canal from Kottapuram to Kolla along with udyogmandal and Champakara Canals etc. in southern part of India and total navigable length was 205
- **National Waterways – 4:** Kakinada – Pondicherry canals integrated with rivers Godavari and Krishna the total navigable length is 1095 km
- **National Waterways – 5:** East Coast Canals along with river Brahmaputra and Mahanadi the total length of 621 km.

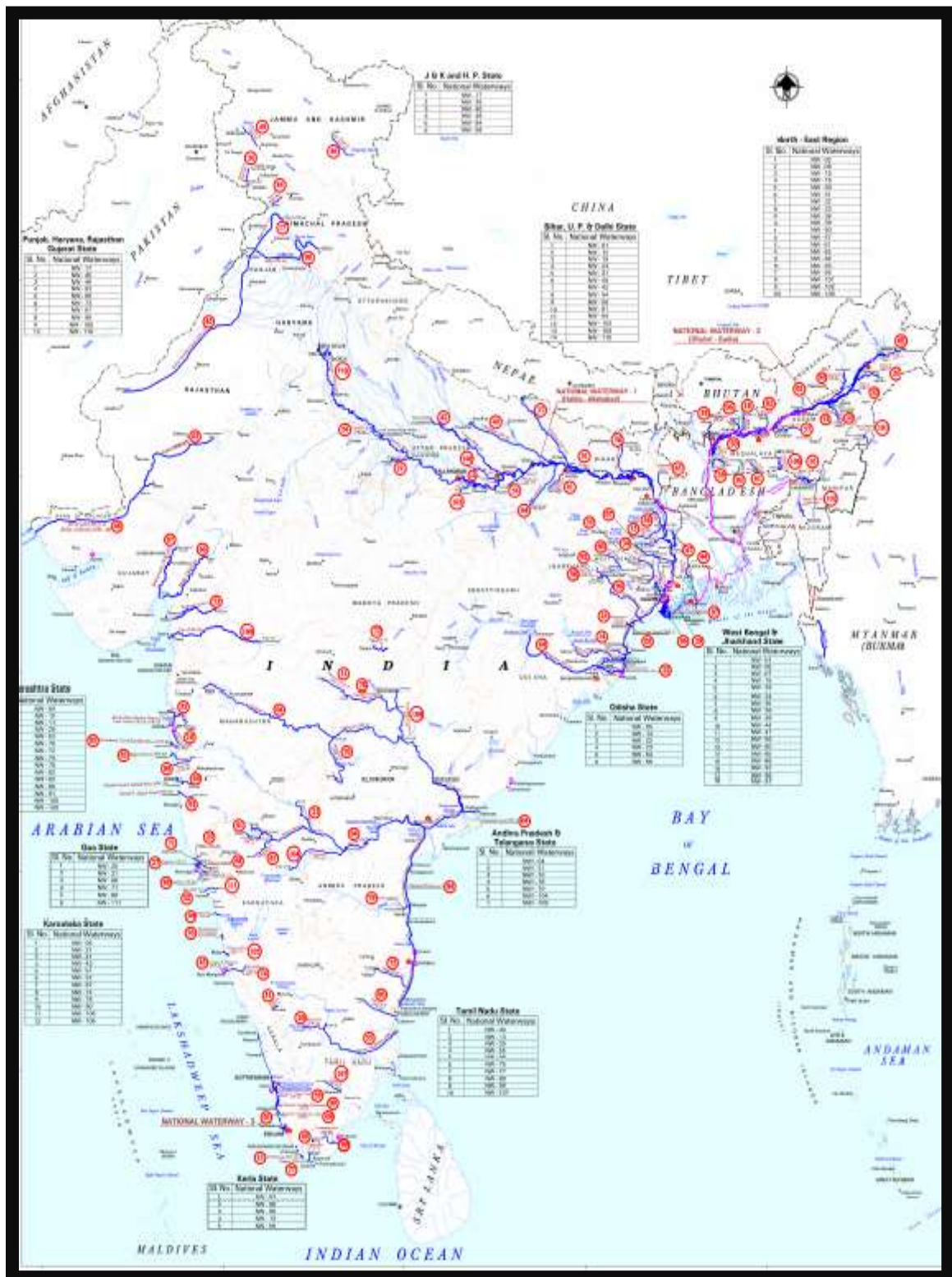
The Development of National Waterways has been taken up on the phased manner in order to provide the alternate mode of transport system in the country, over some of the stretches of National Waterways are commercially viable developed the opportunity for shippers and also attracting various investment through public private sector mode for boosting the IWT base transport in India.

India has wider coverage of Inland Waterways in the form of river, backwater, creeks and canal which is approximate 14500 kms and the costal lines of 7500 kms available, hence in our country there is huge economic opportunity for development of IWT sector and the reformation of various industrial economies possibly be happen with Inland Water Transport Revolution.

Playing of Inland vessels on National Waterways enhances the trade and transit economy along the all hinterland from Varanasi to Haldia, and this catchment area is having major consumption and distribution demand of various types of freight.



(Fig No.29. State wise Average Length of NW-1, Source: Research Analysis)



(Fig. No30. Map of India Indicating 111 National Waterways, Source: IWAI, MoS)²⁴

²⁴ Inland Waterways Authority of India, Government of India (iwai.nic.in)

1.10 Objective of Thesis

1. To identify the various economic investment opportunities associated with Inland Waterways Transportation sector in the Varanasi region.
2. Analysing the various socio - economic benefits to be reap out after development of added infrastructure on National Waterways -1 like Multi Model Terminal & logistics aggregations hub Freight village, ferry and Ro-Ro terminals, cruise liner services for tourism etc.
3. Understanding the IWT efficiency and transportation economies, how it can be leveraged through riverine multimodal transport.
4. Assessment for identifying the various economic benefits received by stakeholders due to developments of water-based transportation infrastructure in the region.
5. Identification of major cargo types to be catered through riverine port and understanding the model shift of supply chain management for existing regional industries, trade and commerce.
6. Understanding about the basic strategic links of various industries, marketplaces, Industrial clusters of Varanasi which can be directly added as economic drivers for utilising National Waterway - 1
7. Assessment of the transportation requirement for general public and addressing the advantage of connecting remote villages to the urban marketplaces through river-based transportation.
8. Transportation needs assessment of existing Industries, stakeholder and general public for tapping the freight flows patterns of various types of cargo and economising trade practices by reducing the total logistics costs.
9. Understanding the various economic activity carried in the region and finding out the connecting linkages with IWT sector.

10. Varanasi city is a major attractor of national and international tourist throughout the year and river front of Ganga has already existing Ghats, holy places, pilgrimages etc. this research will deeply go through the possible opportunity may be tapped for converting prospect of promoting tourism sector at Varanasi.
11. Assessment of upcoming employment opportunities in the region due to operational requirements IWT sector and suggesting the suitable scheme for capacity building.
12. Understanding that how IWT can provide optimal model mix for transport by integrating National Waterways with other mode of transport viz. Railways and Roadways. This research also addresses the existing optimal mix of transport model to utilise the IWT sector for cost and economic reasons.
13. River Ganga is the longest National Waterways of 1620 Km from Allahabad to Haldia among all 111 waterways and passing through the four different states Uttar Pradesh, Bihar, Jharkhand and West Bengal and development of this water transport corridors will influence the interstate trade and commercial activity in the region and this study will identify the new parameters and significance of economic development for promoting interstate trade.
14. The research is intended to identify long run and short run benefits from implementation of environmental and social safeguard management activities on hinterland of National Waterway -1

Chapter 2

Literature Review:

2.1 Historical review of Water Transportation:

Water resources are most critical commonly available property in the world, since time of immemorial we have worshiped and hailed sacred resources, the perennial rivers valleys, basin and deltas has helped to blossom our county cultures, built complex societies, governance systems and civilizations etc.

We have recognised the importance of rivers since long ago and collectively putting efforts to protect and use it in efficient manners and till from historic past to today we are saving our water resources.

Our Country has long historic past of boat and navigation technology since II millennium BC, Harappans (or Indus Civilization) has constructed the first tide dock for berthing of ships at the port town of LOTHAL, Harappan Civilization has already developed their marine transportation technology for trade purposes, the docks has two segments first segments is 18-20 meter long and second was 4-6 meter long, minimum at least two ships can be accommodated at a time, the port harbours are designs in such a way that navigation channels is narrow but can accommodated a bigger ships going into the sea. Terracotta model ships and ships paintings Indus seals are giving the idea that Lotha is port city and ships are going into the sea. Lothal city was located in level plains in between Bhogava and Sabarmati rivers, as per the historian LOTHAL DOCK was the very busy and having presence of large markets, it has greater trade emporiums the goods was traded and brought from its neighbouring towns, the goods was traded and exchanged here, Lothal was developed for overseas trades from the West Cost of India, since that time Civilizations has developed the mechanism of river transportation linked with overseas trades, during that time various industries like bead making, Shell Works, Bronze Smithy are important industries for Surface transportation bullock carts or pack animals were used for long distance land transport, whereas flat bottom boats are developed for Inland Water Transport using river routes, the terracotta gives ideas about the flat bottom boats made of reeds are used for carrying men and light goods. The Harappan Civilization has also developed various Inland marine transport systems used flat boats for navigation in the rivers and lakes, in carbon dating the historian has also found that this civilization has did trades on high seas, coastal areas and Inland rivers routes because their ships are fitted with sails.¹

During excavation the clay model boats was found that completely represents a ship along with sail, it has the sharp keel, pointed prone and high flat stern, it has two holes that means for the mast and other on the edge are may be made for steering. Harappan Civilization has built the unique docks which has provided the facility of handling cargo through Ships and Inland Waterways, the boats were crafted with flat bedded probably they used it for Inland River transport purposes, the Harappan civilization has developed many types of the boats suiting to their requirements of trades.

Harappan Civilization has also recognised the marine powers and developed various types of ships and Inland crafts. Since that time the technology of boat building was developed and it was pass on hereditary from father to Son and there on and the boat building technology was become the monopoly of specific types of people, the boat builders has developed the standard measuring units like hand, fingers and feet. The different types of boat and Arch was developed for marine transportation, the boat was generally constructed by using of teak

¹ <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1868932>

woods and the selection of wood was made based upon the purpose and type of boat was constructed.

The historian has recorded fact that Pushyadeva, the ruler of Sindh (Now it is in Pakistan) has formidable Arab Navy Attack in 756 AD, historically it indicates that Shipping and Navigation technology has given the huge importance, the boats has been developed for different purposes and called with different names like Samanaya, Madhyama and Vissha etc. the boats are used for passenger service, cargo transportation, ferrying on rivers and fishing purposes etc.

The earliest history of India the reference of maritime activities was also recorded in **Rigveda** 1,97,7 and 8 Paragraph where the ship fleet is being used by communities living along the coastal regions, and maritime activities conveys the ship across the sea for our welfares.

2.1.1 Ship Construction Technology

Traditionally the construction of boats or ships starts with laying of keel, it is the foundation of the boat or ship, thereafter the massive supports of wooden pieces were attached, post laying of keel the planks were attached as rib, Keel and stern one single piece of timber are brought in use, the planks are fasten horizontally on either side of keel, the plank was joined edge to edge. Rudder is the flat piece of wood which used for pushing boat forward and lead for expected directional change in all traditional crafts, in few crafts the rudder was replaced by the blades at one or both ends and oar is a pole with flat blade used for rowing a boat, this was used for straight and shift word movement of vessels, generally the ships equipped for using Wind Power. The mast was constructed on the boat keel, that was made up of bamboo timber, the mast was build longer and stronger and sail is the sheet of canvas spread across the mast structure to catch the wind and move the boat and ship forward, the shape of sail is triangular and easily catch the wind, the Sails are fixed with mast and ropes. The sails was used only when the vessel are going into the mid sea where they can use maximum use of wind energy for sailing.

²LOTHAL is the world Oldest Dock, it is believed that Asian Maritime History is 3700 years old, the Lothal dock is the tidal dock, at north end of the town a basin with a vertical wall was build that may be used as Inlet and outlet channels. The historian analysis shown that Lothal is located in between Sabarmati River and its tributary Bhogavo in the Saurashtra region, presently the sea is 19 Km away from the Lothal site but once upon a time the boats from the Gulf of Cambay could sailed up to the spot, the Harappan Civilization was flourished along the basin of River Indus, the presence of dockyard on the eastern edge of the site is impressive, time town was bounded by the brick walls, the operations mechanism of the dockyard was impressive of its time, the town planning has ensured for regular flow of water level by help of sluice gate and a spill channel and on western side the mud brick plate form is created that may be made mean for loading and unloading of goods for trades.

² Ministry of Ports & Shipping (portmin.gov.lk)

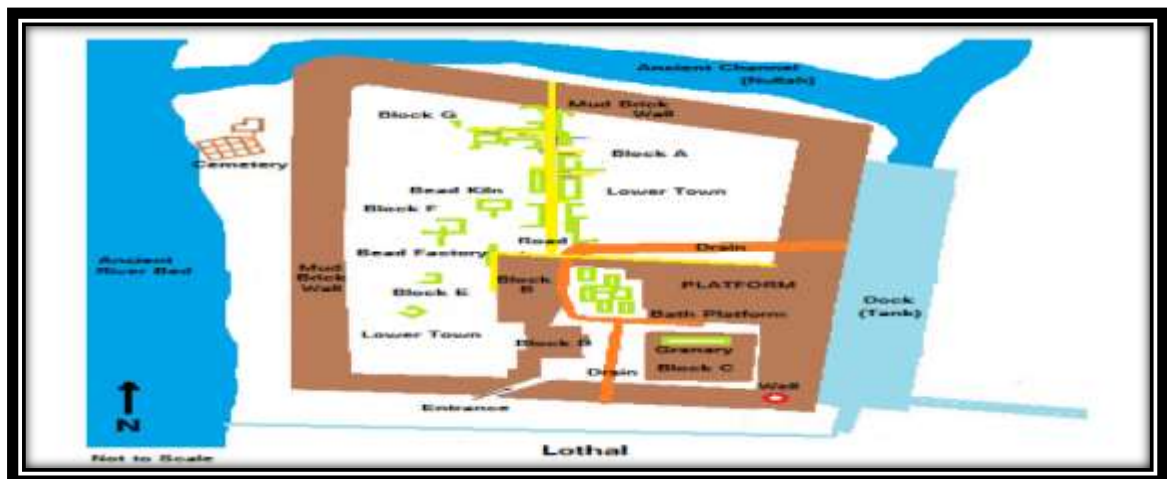
Year End Review -2022 Indian Ministry of Ports, Shipping and Waterways (marineinsight.com),

<https://www.marineinsight.com/shipping-news/year-end-review-2022-indian-ministry-of-ports-shipping-and-waterways/>

Lothal was the Industrial harbour town where the copper was imported and produced bronze Celts, chisel, fishing hooks, spearheads and ornaments etc. the beads and shells of fine quality are produced for trade and export purposes.

The Lothal site is flood prone area the town slowly shrank, ships stop coming at this dock site and slowly-slowly the town become abandoned.

The site has availability of warehouse facility for storage, the warehouse played the economy of town it stored all traded goods and foods stocks either for being exported or Imported, Lothal has commercial nature of production of goods and this makes the Harrapn site as crucial for maritime history.



(Fig No.31. Town Plan of Lothal, Harappa Civilization Site, Source: www.livehistoryindia.com, dated 05.05.2020)³



(Fig No.32. The ancient Indus port of Lothal picture as envisaged by the Archaeological Survey of India, Source: www.harappa.com, dated 05.05.2020)⁴

³ www.livehistoryindia.com, dated 05.05.2020

⁴ www.harappa.com, dated 05.05.2020

2.2 Overview of Multi-Modal Transportation:

The Multimodal Transportation is the arrangement of movement of goods by using two or more modes of carriers but with single point of contact who is legally liable for performing entire logistics operations, the logistics carrier is not necessarily responsible to perform entire transport operations in accomplishment of shipment.

The multimodal transportation operations involved various intermediate carriers who performs their agreed logistics activity such as loading, unloading, first mile and last mile and storage etc. on ground the legal responsibility of entire logistics operations are taken by Multi Modal Transport Operator (MTO)

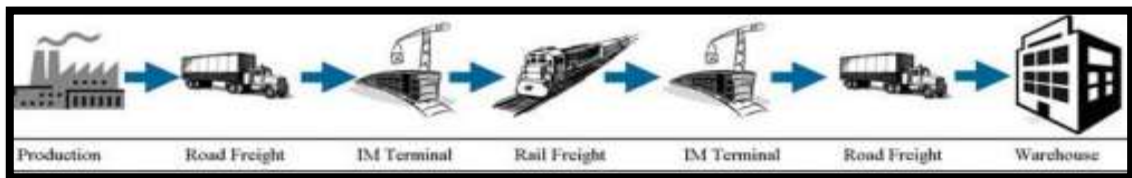
Multimodal transporter helps for moving freight in combination with several modes of transports like truck, railways, and airways and shipping both domestic and internationally the cargo is moved with help of multimodal transport system.

Under the multimodal transport system various carriers are responsible to perform their assigned function to finish the transport operations, the multimodal transportation of freight has benefitted many businesses for management of their logistics at economical cost.

Now a days the multimodal transportation operations are become fastest in delivery of shipment and reduced the transit time at large extent, the carriers have the lowest price in operation cost which increase overall profitability and productivity, the multimodal transportation requires co-ordinated approach in handling of freight through various transport modes and multimodal transportation methods applicable for carrying larger volume of cargo for long distances at reduced cost as compared with conventional modes of transport.

The Varanasi hinterland has mammoth prospects of utilizing IWT based model mixed of multimodal supply chain operations in the region.

2.2.1 Model Layout 1st of Multimodal transport operations held with Railways and roadways mix modes at Varanasi



(Fig. No.33. Multimodal layout in combination with roadways and railways Infrastructure)

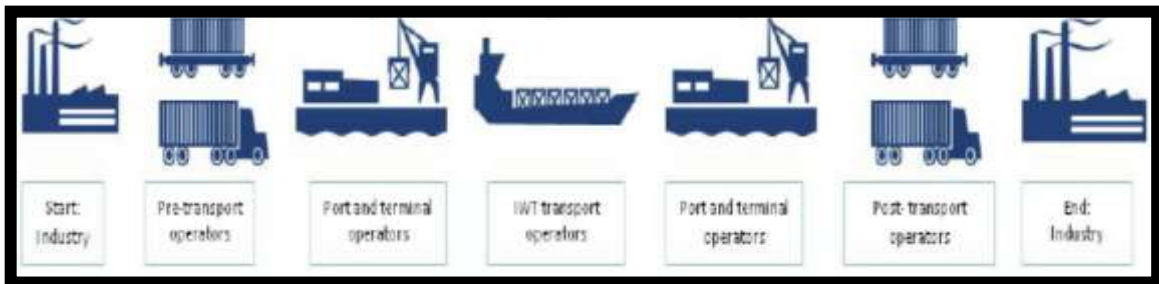
The above multimodal transportation mix requires several times handling of cargo during handling of shipment from its origin point to destination point, in this layout the cargo origin point is production centre where cargo packed according to the suitable transport mode, then consignment loaded on trucks for completing first mile transport, after completing first mile journey the cargo is unloaded at intermodal railways origin terminal, thereafter loading operations were performed at Inter model railways terminal, again the cargo was loaded on Railways Wagons for long distance inland transportation through established railways networks, post reaching at intermodal model railways destination terminal again the cargo was unloaded from railways racks and reloaded on multiple trucks for last mile transport, finally cargo reaches to its destination where unloaded and stored.

Presently at Varanasi Madhosingh and Manduwadih railway stations are performing rail head based multi model freight handling operations with Indian railways.



(Fig. No.34. Multi-Model Freight Operations by using model mix of Roadways and Railways)

2.2.2 Model Layout 2nd for Multimodal Transport Operation proposed with model – mix of IWT routes (National Waterway 1) and Roadways at Varanasi:



(Fig. No.35. Multimodal layout to be followed with IWT MMT Varanasi)

This model mix of cargo handling become now possible now at Varanasi due to development of riverine multimodal port on National Waterway 1 (Ganga-Bhagirathi-Hooghly) river system. The cargo handling with Inland Water Transport system with above Multi-Modal transportation layout is reality.

Now development of IWT sector at Varanasi unveils various hidden economic opportunity in the eastern Uttar Pradesh region and the MMT will help in building of transport related business in coming years.

It is observed that population density along NW1 is very high, hence there will be forever higher logistics demand and it may follow growth trend as per the gross domestic product growth rate.

The IWT based multimodal transport logistics operations at Varanasi involve multiple handling of freight, the riverine port has railways and roadways connectivity for performing of first last mile transport, therefore the above logistics layout are best applicable in Varanasi region where consignment are get packed at production centre according to the needs of selected transport modes, then shipment loaded on trucks or rail head for completing its first mile journey up to IWT MMT Varanasi for further logistics operations by using national waterways 1, thereafter shipment was unloaded at MMT Varanasi after first mile transportation end and the consignment is loaded on Inland Water Transport Vessel, post

finishing of loading operations the sailing of vessels occurs along National Waterways 1 and cargo transportation operations occurs by using National IWT routes. When vessel reached to its destination or port of call, then again unloading takes place and shipment transhipped through rail head or trucks for road last mile transportation operations, finally the cargo reaches to its final destination.

Similarly, the reverse logistics transportation operations can also be carried by using the above both modes of transportation.

The IWT based multimodal transportation opens the window of opportunity to establish international trade in the region, the presence of MMT will simulate formulation of business strategies and supports in preparation of various programmes frameworks to improve efficiency of logistics handling

The development of Inland Water Transport network at Varanasi become paradigmatic for development of Indian industrial facilities along the hinterlands of National Waterway 1



(Fig. No. 36 Inauguration of IWT Multi-Model Terminal on River Ganga at Varanasi)⁵

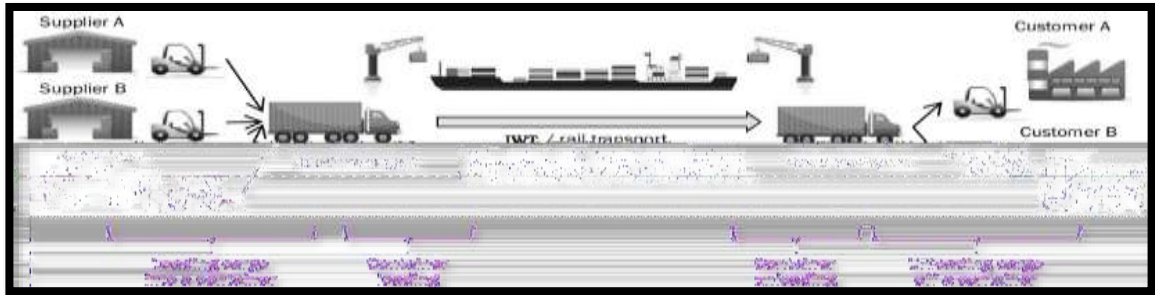
2.2.3 Model Layout 3rd Upcoming model plan of logistics handling facility at Varanasi:

Varanasi region has gain strategic advantages to future handle logistics efficiently, the presence of strategic logistics infrastructure at one place makes the region as logistics hub.

⁵ Photograph of Varanasi MMT taken on 12.02.2018

The development of MMT on NW-1 is become game changer for the economy of Varanasi district. The facility is integrating with three different modes of transport at one place with having almost central geographic position in between eastern and northern part of India.

The development of IWT Multi-model terminal along with roadways and railways connectivity makes the Varanasi MMT most unique for cargo transshipment hub or Logistics hub, with development of necessary infrastructure like MMT along with Freight village the region will serve under the model of hub and spoke for aggregation and handling of logistics.



(Fig. No.37 The shipper follows combined multi-model logistics layout by using MMT Varanasi)

Now with presence of IWT MMT Varanasi the shipper will have multiple choice for selecting transport modes to make their handling of shipment effectively and they select any modes of transport as per suiting to their requirements.

The MMT Varanasi will provides lot of flexibility options to the transporters, cargo owners and shippers to make the handling of cargo with best possible low cost and help to reduce the total logistics cost in their business.

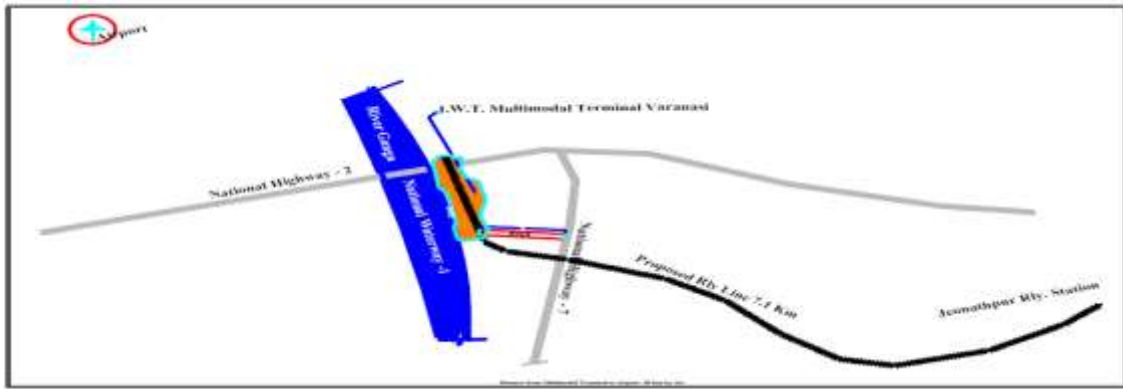
The strategic development of transport infrastructure along the National Waterways 1 will minimise the handling of cargo especially for long distance first and last mile connectivity, the plan of development of freight village just beside the MMT will yield the various economic benefits to the various stakeholders.

The systematized logistics handling facility at Varanasi will enhance the trade and transport operations in the region and also lead to make various investments form the private parties in setting up of the new economic business there, which results for yielding the multiple benefits for the Varanasi and nearby region.

MMT Varanasi will be the game changer in economic activities carried in future and the “City of Temple” will be transformed as the “City of Port” in coming years.

2.3 Varanasi MMT a Focal Point for Logistics Sector:

Varanasi MMT has geographically strategic importance for development of logistics and transshipment hub for cargo movement in the country, the various modes of transport i.e roadways, railways and waterways are merging here, hence the city is upcoming as the centre for logistics hubs, The Indian Railways are putting their efforts for development of 1st phase of Eastern Dedicated Freight Corridors up to the Varanasi merging with MMT and the major National highways NH2 & NH7 are also merging at near MMT Varanasi .



(Fig No.38. Site Layout of IWT Multimodal Terminal at Ramnagar, Varanasi, U.P)

As per the study conducted by Inland Waterways Authority of India the revealed that Varanasi Multimodal terminal has phenomenal increase in the cargo traffic in future because the Indian Railways freight handling and National Highways are already commissioned and the Inland Waterways Multimodal Terminal developed here will definitely boost the choice of shipper for transportation and transshipment of their cargo on any modes of transport.

MMT Varanasi with roadways connectivity with NH2 & NH7 and Railways connectivity with Jeonathpur railways station on Eastern Dedicated Freight Corridors, All three modes Railways, Roadways and Waterways modes of transport are merging at one place and each of the transport modes are complementary to each other for facilitating for movement of freight traffic.

The freight forwards, cargo owners and Shippers has the choice to choose any modes of transport suiting to them.

Presently the IWT terminal at Varanasi is commissioned and inaugurated by Hon'ble Prime Minister of India on 12.11.2018 and the terminal infrastructure is also under development, now the strategic economic development is expected as the logistics companies, manufacturing sector and trading companies possibly to establish their business here.

The Multi Model Terminal at Varanasi may likely to establish a productive logistics neighbourhood which enhance the ease of doing business.

2.3.1 Road Connectivity with Varanasi MMT

Varanasi MMT terminal has good roadways connectivity with National Highway, the two major highways are intersecting near the vicinity of the terminal hinterland NH 7 and NH 2 both road networks are available here and these road networks are the part of golden quadrilateral.

2.3.2 Rail Connectivity with Varanasi MMT

In order to facilitate the efficient cargo movement, it is proposed that in second phase construction of MMT Varanasi will be developed connecting railways line of 5.1 Km from Jeonathpur railway station and give access to the Eastern Dedicated Freight Corridors Railways lines to move cargo up to the MMT by mode of railways.

2.3.3 Air Connectivity with Varanasi MMT

Varanasi city have already International Airport "Lal Bahadur Shashtri International Airport" which is approximately 37 kilometers from the IWT MMT Varanasi.

Hence Varanasi MMT is located at strategic geography where all modes of transport are integrating and such integration in the land locked area are rare to the rarest in the world. Hence the river Ganga is again proving as blessing for the Kashi to build the city of logistics in the northern region.

2.4 Overview of Uttar Pradesh

Among all 28 states and 8 union territories Uttar Pradesh is fourth largest states in India by its geography, the state consisting 75 districts and having largest states in population wise in India, approximate more than 16% of the Indian Populations are living in this state, and the compounded annual growth rate of the state is around 10.82% and the contribution of the state in National GDP is around 8%.

Uttar Pradesh has highly fertile land of Ganga and Yamuna plains which make the state as granary of India, the state contribute 17.83% of total grain production of India and 16.83% of contribution in dairy productions respectively.

Uttar Pradesh has many manufacturing, processing and agri-input based industries establishes, the major agro based industry in the state is Sugar Mills which accounts for the production of 28% of sugar of the country, the state is also having mineral resources and various number of cements, power, aluminium, chemical and other heavy industries are located in the eastern region of the state.⁶

The Sonbhadra and Mirzapur region of the state have various mineral deposits and massive mining activities are carried out in the region, Bauxite, limestone, sand, stone and coal resources are in abundance quantity.

The state has other major contributors such as Vegetable Oil, Jute, handicraft, Carpet of Bhadohi, Silk brocades of Varanasi, Ornamental brass works, Chikan of Lucknow, Glassware works of Firozabad, wood and stone carving etc. are also having role in contribution of GDP of the country.

Uttar Pradesh is the larger producer of Vegetables, wheat, rice, maize, millets, gram, pea, and lentils etc. The state has approximate 17.83 percentage of contribution in the food grain output of the country in the year 2016-2017.

Uttar Pradesh is also having significant contribution in the dairy sector approximate 16.83% of dairy products are produced in the state, the growth of dairy sector in the state is expected for exponential growth, the national dairy plan is introduced in 8 district of Uttar Pradesh i.e Meerut, Ambedkarnagar, Lucknow, Bijnore, Gonda, Farrukhabad, Barabanki and Faizabad.

The state having enormous potential for development of tourism sector the state has approximate 2.37 million of domestic and foreign tourist visits to the various sites of the state, the state has focused on increasing the expenditure of budget for development of tourism sector in the state and it is expected that approximate 10-15 percentage of increase in the tourist footfall will be recorded in the state.

Uttar Pradesh is the home of approximate 200 million of population and approximate 30 percentage population of the state is living under the poverty line, in this agriculture sector is remain primary sector for gaining livelihood of the population, the government has initiated

⁶ India Smart City Mission Report, Municipal Corporation of Varanasi, Uttar Pradesh and Ministry of Urban Development, Government of India

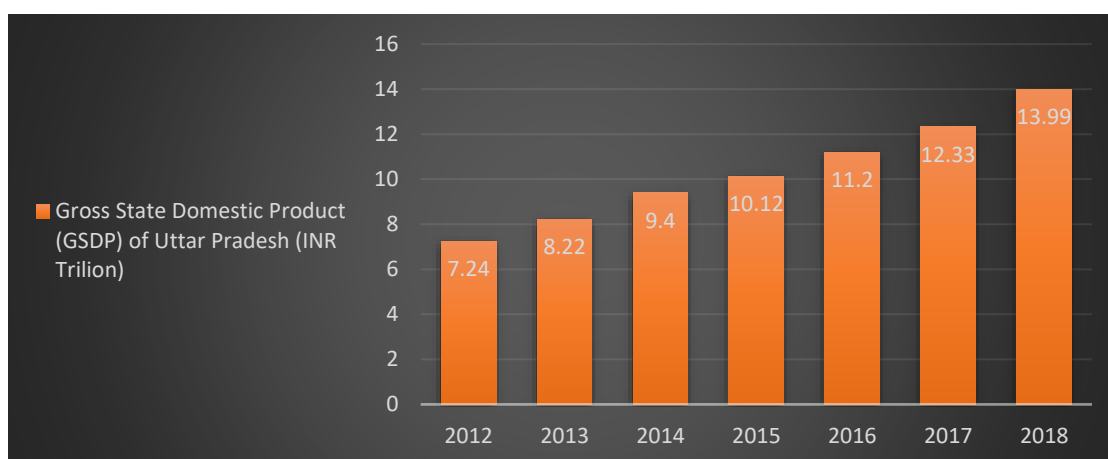
to make economic structural reform in the state and it is expected that population will get some gainful employment in MSME sectors.

The state has huge Gaps in the infrastructure plan and investments, the state is landlocked and the major freight handling were occurred with help of roadways and railways modes of transportation, but construction of Multimodal terminal at Varanasi on River Ganga will opens up the potential opportunity of Marine trade in the state.

The economy of Uttar Pradesh is growing but having larger geographical area hence the development of trade and commercial activities in the region requires strategical logistics planning and cost efficient transportation system, the state has already good networks of Roadways and Highways but the utilization of these infrastructure is at optimum in the region due to presence of dense population, the growth of urban population in the state has been recorded and it will be approximate 22.2 million by 2021.

Uttar Pradesh has recorded year wise growth in their Gross State Domestic Product it signifies that the economic growth activity in the state has taking rise year on year, the state has active participation in the development of the country, post analysing the data it was found that the compounded annual growth rate of Uttar Pradesh is 10.80 percentage from 2012 - 2018

2.4.1 Gross State Domestic Product of Uttar Pradesh ⁷



(Fig.

No.39. Source: Directorate of Economics and Statistics, Govt. of Uttar Pradesh & CSO)

The Uttar Pradesh hinterland has an extensive agriculture production and establishment of various industries in the state which requires trunk transportation routes, hence the development of MMT at Varanasi will have parallel benefit in increasing the state gross domestic production and expected to double the SGDP within the next 10 years of time span.

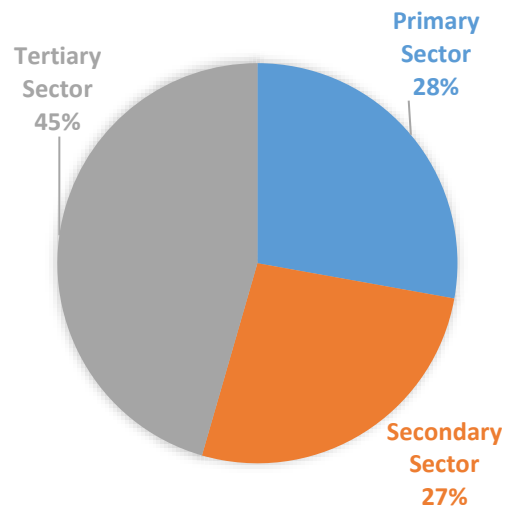
⁷ Report on Rising Uttar Pradesh, One District One Product Summit, PHD chamber of Commerce and Industry, New Delhi

2.4.2 Economic Percentage Distribution of GSVA in Uttar Pradesh ⁸

Analysis on of contribution made by various sectors i.e Primary sector, Secondary sector and Tertiary Sector in Gross State Value Addition at current price in Uttar Pradesh.

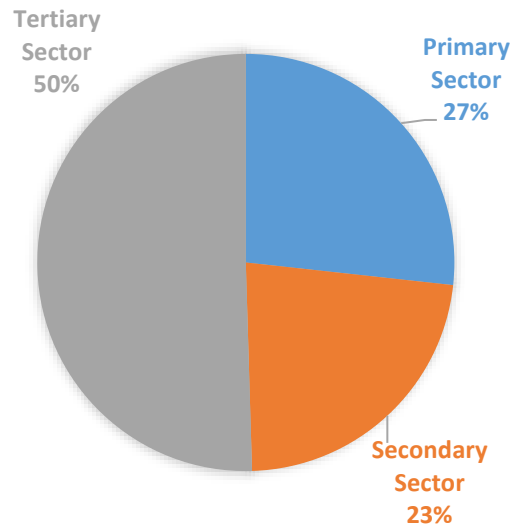
Base Year 2011-2012

In Uttar Pradesh during base year 2011-2012 the contribution of primary sector in GSVA was 28%, secondary sector has 27% and Tertiary sector has 45% respectively.



Year 2017-2018

In this year sectoral distribution of GSVA in Uttar Pradesh has recorded for primary sector is 27%, secondary sector has 23% and Tertiary sector has 50% respectively.



(Data Source: Directorate of Statistics and Economic Uttar Pradesh, Central Statistics Organization and IBEF)

It has been identified that there has been shift in the sectoral contribution from Secondary and Primary to Tertiary, hence the Tertiary sector of the state has grown faster at the rate of approx. 11 percentage.

It is expected that the growth of tertiary sector has been possible in the Uttar Pradesh due to increased efficiency in Trades and better economic performance recorded by tertiary sector Industries like Real Estate, Transportation, Hotels, Banking & Finance and other services etc.

⁸ Directorate of Statistics and Economic Uttar Pradesh, Central Statistics Organization and IBEF

The present government has focussed for the development of IWT Inland Multimodal Terminal at Varanasi along the Ganga where world class logistics infrastructure are planned to be developed for freight transportation through Inland waterways mode.

The MMT Varanasi terminal offers integration of roadways and railways head just immediate to the terminal where cargo transshipment can be done efficiently, whereas Airport is located just 37Km away from the MMT Varanasi hence the user may utilize that asset for faster transportation as per their requirements.

Uttar Pradesh is the land of opportunity its true, here the growth for tertiary sector has tremendous and development of IWT based transportation may pushes in positive changing for economic impetus in eastern Uttar Pradesh, the city like Varanasi has more opportunity in tertiary sector, it may increase by double digit because enhancement of transportation business may lead to Increase in tourism business opportunity.

IWT sector is preparing Varanasi as hub for logistics industry in northern India, the development of riverine port on Ganga encourages investments in establishment of various type of industries in the region which leads to increase the employment opportunity, when more number of local population may get potential employment and this will lead towards for increasing per-capita income of the region.

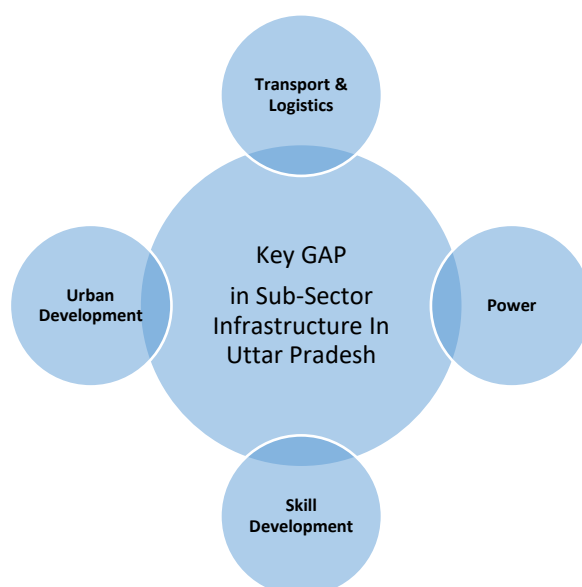
Inland Water Transportation sector are touching for the development of neglected economic regional counters, IWT have reaches in most interior rural hinterland of the state and this sector is integrating the rural, coastal community to the main economic stream of the country by providing connectivity and logistics services.

IWT has potential for increasing the various self-employment in the region, most importantly it touches to the most backward and lower economic marginalised sections of the society such as fisherman community, boatman community, land less farmer, agriculturist and rural villagers who is cultivating along the banks of river Ganga and also benefitted to the poorest and most rural sections of the society in the region.

In one hand where India is thinking for doubling of farmers Income the various methods are using by the Ministry of Agriculture for increasing the productivity of their farm land but it can't be ignored that the rural hinterland farmers are most suffer in the transportation of their produce to the urban market place due to various reasons.

But IWT sector has vast reaches to the agricultural hinterland along its basin the National Waterway from Allahabad to Haldia has 1620 kms of stretch there is vast agricultural cultivating zone, again the population of Varanasi region will be get benefitted directly by the Inland Water Transport services.

The farmers can take ferry or Ro-Ro services and reach to the urban market places directly from their hinterland only and such transition of rural transportation with Inland Waterways will increase the efficiency of economic growth of the region.



(Fig No.41. Source: ADB briefs No. 120, December 2019)

The Industrial Economic growth of the Uttar Pradesh is anchored by presence of large industrial firms, the networks of various MSME industrial clusters and regional small-scale industries located which is creating economic value chain.¹⁰

The economic zone of the Uttar Pradesh is divided into the five different zones based upon the presence in the region specific and they are key economic drivers of the state which has potential of generating economic value and employment.

The key industries of Uttar Pradesh required zone wise development framework which required better industrial and Infrastructure planning in order to achieve the economic growth, it is essential to have the growth in the existence key gaps in sub-sector economy to drive the industrial strategy of the state.

The Transport and logistics are the important sub-sector for accelerating the Industrial Growth of Uttar Pradesh, therefore the priority Investment are need in the Transport sector to gain value added competitive advantages.

The efficient transport are essentially required for exporting the produce of key industries of state in which IWT Multi-Model Terminal Varanasi will play vital role and offers ease of transportation and promotes export of goods for key Industries located.

¹⁰ ADB briefs No. 120, December 2019

2.5.1 Six Major Zones of Core Industries in Uttar Pradesh: ¹¹

The Uttar Pradesh has six major zones of having Key Industries such as Western Zone, Northern Zone, Eastern Zone, Central Zone, South Western Zone and Bundelkhand Zone etc. These zones are having various key industries which has potential for contributing approximate 70 percentage of economic output in manufacturing sector and heat zone for generating maximum employment opportunity.



(Fig. No. 42. Source: Analysis by ADB study team based on data drawn from the Government of U.P)

2.5.2 Macro-View on Existence of Key Industry, MSME and Economic Clusters Located in the Eastern Region of Uttar Pradesh:

The economy eastern region of Uttar Pradesh based on clubbing of various industries and MSME clusters located in the districts of Varanasi, Chandauli, Sonebhadra, Mirzapur, Ghazipur, Allahabad, St. Ravidas Nagar, Jaunpur, Gorakhpur and Ballia districts etc.

The key industries are which located in Sonebhadra, Allahabad, Gorakhpur and Varanasi here are contributing approximate 60 percentage of economic output of eastern zone.

Across Uttar Pradesh requirements of investments in the development of essential infrastructure needed for eastern region only, hence the issues are immediately needed to address for transport infrastructure, warehouses, power and skill development etc. Sonebhadra, Allahabad, Gorakhpur and Varanasi are the spinal cord of eastern Uttar Pradesh these districts are way connecting for generating a greater number of employment opportunity, hence the state has to focus for the development of necessary infrastructure are essentially needed such as development of Transport infrastructure, Airports, Multimodal Logistics Hubs, Freight Village and all necessary trunk infrastructure required for development for local level Industrial clusters.

¹¹ Analysis by ADB study team based on data drawn from the Government of U.P



(Fig No.43. Movement of IWT Vessel along National Waterway-1)¹²

¹² Photograph of Ro-Ro Vessel of Inland Waterways Authority of India plying on river Ganga.

2.5.3 Key Industrial establishment, MSME and various economic clusters found in the potential districts of eastern Uttar Pradesh¹³



(Fig No.44. Source: Ministry of MSME Report on District Industrial Profile)

¹³ Ministry of MSME Report on District Industrial Profile

2.6 Overview of Varanasi District (Kashi or Benaras):

Varanasi is cultural capital of India and having well established commercial centre of eastern Uttar Pradesh and western parts of Bihar states, the city is catering needs of approximate 10-13 corers populations living in its catchment area, being oldest city Varanasi is prominent worldwide since ancient times, the city is known as cultural capital for Hindu, Buddhism, Christian and Muslims and called as heart of all religions, city has attractor of passenger and tourist traffic year around due to well-known pilgrimage, temple, Ganga Ghats, tourism sites, healthcare & educations facilities etc. city has also a hub of business trade, business and commerce activity popularly known for artistic handicraft, handlooms and carpets related clusters etc. the region has presence of various special economic zones (SEZ) and Industrial Areas which contributing significant in economic development of the country.

The present transportation infrastructure of Varanasi city is stressed and overburdened due to dense urban settlement, narrower lanes, encroachments and congested roads along with presence of various Archaeological Survey of India (ASI) sites, this reduces scope for widening of existing roads and dense settlement creates regular burden on road, continuously increasing number of vehicles counts year by year that leads to the traffic issues and make the inadequacy for catering mobility needs of populations.

Current transportation infrastructure profile of the city is facing difficulty in catering intra-city transportation, the movement of goods and passengers have inadequacy of public mode transport, only the city has presence of least reliable para transits modes for commuting, the presence of narrower lanes and congested roads slows down the traffic movement, city is having presence of larger number of para-transits modes for local transport and gathering of large number of paratransit at one place chock the roads that leads for congestion and inefficiency in intra city passenger mobility.

The Varanasi is located at eastern at eastern bank of river Ganga and the urban settlements of city are establishes from north to south directions facing towards the river bank, annually Varanasi is registering increasing vehicle populations of 9-10 percent which is creating additionally burden on the city transportation infrastructure.

Varanasi is the religious capital, philosophical and cultural capital of India, millions of foreign tourists were arrived, Sarnath is the important pilgrimage for Buddhist at this place Lord Buddha has given his first Sermons here, the river front of the city has aesthetic natural view and unique directional change of Ganga River flows from South to North in crescent shape and having confluence of river Assi and Varuna that led to be considered most holy places for Hinduism religious shrines.

The developments of multi modal terminal at Varanasi will opens the doors of various economic investments opportunities and offers various economic benefits, IWT sector has tremendous potential and become the economic game changer of Varanasi.

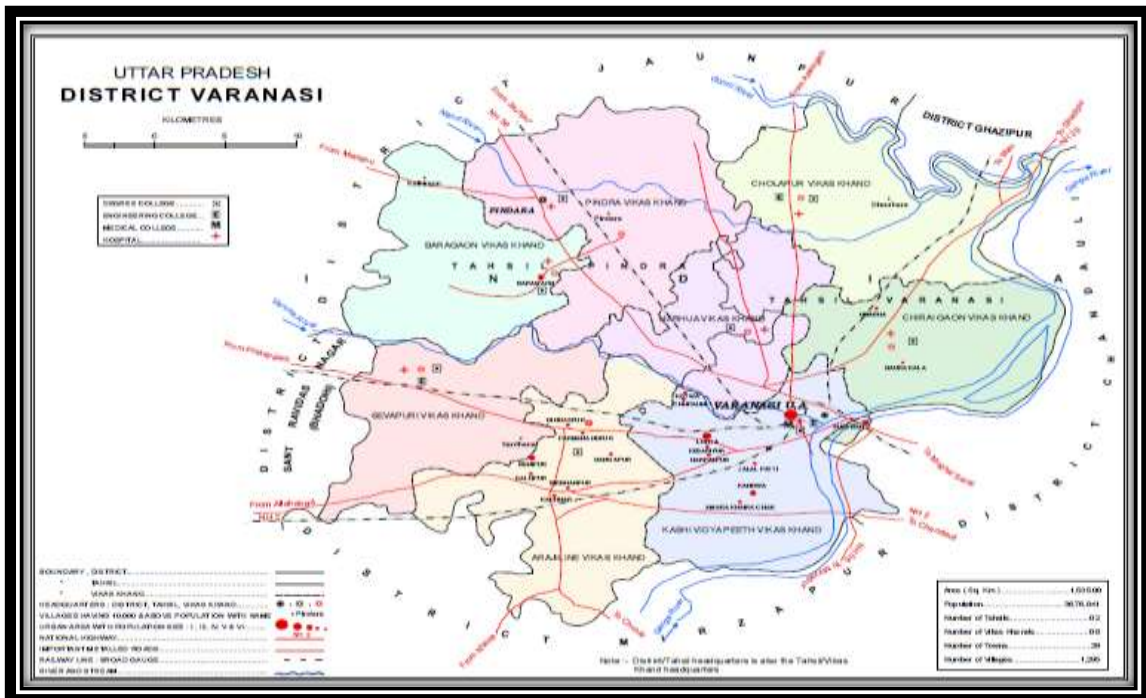
Inland Water Transport sector connects rural areas to urban markets and influence various types of economic activity in the region, the efficient logistics support may lead towards the rapid development of various agro-based industries situated along the river banks, the existing economic units may utilise water transport facility to access the urban markets. Whereas the rural population who engaged in the agriculture activities and lives along Ganga hinterlands for them IWT will offers seamless connectivity of transport and give access of markets through river routes direct their economic participation in country GDP

Varanasi region borders with Jaunpur district in North, Ghazipur district in North East, Chandauli in East and Mirzapur+Sant Ravidas Nagar in West, the total area of Varanasi district is 1535 Square Kilometres and having total population of 31.48 lakhs

The Varanasi region is well connected with Railways and Roadways network and at this location both northern and eastern railways are located here, the two different zones of railways junctions here at Mughalsarai Station which is 17 Km apart, being in central position the location has bigger advantages as per transportation point of view and in has greater impact of business activity in India.

Indian railways have created a bigger rail yard here for transshipment of cargo on roadways network, whereas the road transport has also merged with three National Highways here and Air service is also available at Babatpur airport which is 22Km away from the city.

The region has witnessed as mammoth centre of business in eastern part of Uttar Pradesh, many types of goods are exported from Varanasi city specially the carpet, garments with Jari, and jardi works, glass beads, Kalangai and Mukut, Woods Toy, are exported all over the world, the various small scale and village cottage industries are located in the region, handlooms and power looms are weaving silk and Benarasi Saree which is exported throughout the world.



(Fig. No.45. Map of Varanasi City, Source: Directorate of Census Operations, Lucknow, UP)¹⁴

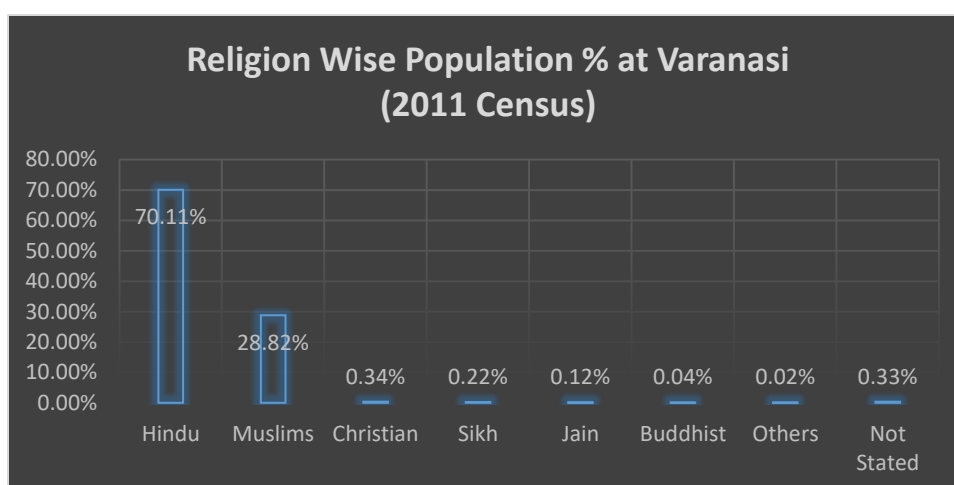
¹⁴ Directorate of Census Operations, Lucknow, UP

2.6.1 Key Demographic Profile of Varanasi District¹⁵

• Location	Longitude 83.0 Latitude: 25.20
• Geographical Area (2001)	1535 per.sq.km
• Population (2011)	3,676,841
• Male (2011)	1,921,857
• Female (2011)	1,754,984
• Sex Ratio	913
• Population Density	2395 per.sq.km
• Literacy	75.60%

(Data source: Website of District Administration, Varanasi & Central Statistical organization)

2.6.2 Varanasi city is the home of all religion but Hinduism has the majority



(Fig. No. 46. Population Demography of Varanasi City Data Source: www. Census2011.co.in, dated 10.04.2020)

Varanasi has good base of agricultural and industrial base and there are reasonable numbers of large, medium and small-scale industries are setup.

The city caters various different types of needs of populations such as education, business, tourism, medical & healthcare, religious, communication and transport, postal, administrative & courts, banks & financial Institutions, mandis & regular markets, sports & recreations, cinema, public library and community halls etc.

The river Ganga is declared as National Waterway 1 as the river has potential for providing better alternative logistics modes for transportation freight and passenger.

Geographic coordinates of Varanasi city

Latitude: 25°19'0.1" N and Longitude: 83°0'37.5" E

¹⁵ Website of District Administration, Varanasi & Central Statistical organization
www. Census2011.co.in, dated 10.04.2020

Varanasi is located on the eastern bank of river Ganga; the urban core of city is established within proximity of river hinterlands of Ganga Ghats hence development of water transport facility near Varanasi has strategic advantage for public benefits.

The city Socio-economic profile has majority of the population are under the category of middle-income class and public has usages for more two-wheeler and three-wheeler segments of vehicles in the way needs of transportation catered. The crescent shape of river follows at Varanasi is having unique and religious advantageous hence it has gained higher spiritual importance.

As per the report published in the last census 2011 the per capita income of the city was identified that INR 16,276 generally the city has identified in the low-income level in the region and reflected in the transportation profile.

The development patterns of Uttar Pradesh Western and Eastern region have large infrastructure imbalances in terms of growth profile, nationwide the provision of bus transportation is lowest approximate there is 1 Bus availability per 2500 of populations

The Modal characteristics of Varanasi city showed the localised transport and faster inter-regional commerce and trades in future the development of Inland Water Transport accommodate the transportation patterns of the city.

In terms of transportation Uttar Pradesh has secured the lowest ranks Varanasi city is the fifth largest city in Uttar Pradesh, as per the government 2011 data census approximate 1.7 million population are living in Varanasi region

The growth of the city is primarily observed that historical located places along with the river fronts of river Ganga, the populations and urban settlements are located along the river Ghats

This results the Varanasi city has dense populations and narrower lanes settlement patterns where the mixed usages of industry and commerce takes place,



The culture of Varanasi is tightly woven and intertwined with religious activities and traditions, but intervention of the modern era the city has vastly impacted and various other infrastructures were created.

(Fig No.47. View of Ganga Aarti, religious and cultural activities are carried out every day along the Ganga Ghats of Varanasi)

Now extend of the development of railways and roadways transportation networks the creation of infrastructure was identified along the existing railway lines and roadside.

The creation of river linkages by construction of bridges along the Ganga at Varanasi enables the expansion of population's movements along the West and Eastern Banks,

Majority of the public crosses the river for meeting their various economic needs and regularly commuting to the Varanasi for Healthcare, Education, Market, Commercial Trades and Supply, Courts and Government offices and Employment and Job Purposes etc.

Opposite bank of Varanasi city Ganga Ghats, Chandauli district is located which is presently connected with road and rails but the infrastructure is over stress due to rapid rise in the population heat of Varanasi city.

Being older city Varanasi is the most economic attractive areas where regional population daily travels with help of paratransit modes to meet their various needs where the majority of the resources, infrastructures were located at eastern bank of river Ganga.

Internationally the Varanasi city is picturing as religious centre in the world and the silk of Varanasi city is well known and mostly famous Banarsi Sari which is used during the Weddings in India.

Due above these factors the city is populated and having existence of various economic indicators there the oldest part of the Varanasi city is serving as the centre of business areas for both Varanasi and Chandauli district, therefore regional traffic movement patters are observed, mostly these commercial places has promoted the urbanization and regional economic mobility, at Varanasi the two-wheeler and auto are the most prominent modes

of travel in the city.



(Fig. no.48. Source: Satellite Images of Varanasi City taken from Google Earth)¹⁶

Break bulk, containers and over dimensional cargo are transported easily through waterways. The inland water transportation always considered as economic, cost effective, reliable and less polluting mode of transport compared to any other surface modes of transport such as railways and roadways.

The developing countries like India understands the economic potential of river and start promoting water-based transportation since 1986 but government has taken very few steps for

¹⁶ Satellite Images of Varanasi City taken from Google Earth

its developments due to other countries priorities. Now increasing uncertainties in transportation due to rising population, crunching demands of logistics on existing busy roads and railway networks that results the slowing down movements compare to actual requirements and also it increases overall logistics costs. The expenditure on logistics costs incurred in India are estimated for 18 percent of the overall country's GDP.

The Government has taken various major steps towards reviving river Ganga and developing reliable National Waterway 1 for ferry operations and cargo movement on the sector of Halida-Varanasi-Allahabad stretch, approximate total distance of 1620 km. The river Ganga called National waterway -1 and having the potential to serve as leading logistics artery for northern Indian states.

Present government has taken steps forward for capacity augmentation of river Ganga to make suitable for navigation with assistance and finance from World Bank for development of river Ganga as national waterways, this effort put in place all IWT infrastructure and services offered emerges as an efficient transportation options.

The cabinet of present government has given their ascent for development and implementation of Jal Marg Vikas Project for capacity augmentation & navigation on river Ganga at with cost of Rs. 5369.18 crore and provided technical assistance with investment support from World Bank.

Varanasi city can be a key location on National Waterway – (NW-1) due to its strategic geographic advantage that facilitates transshipment of domestic & EXIM freight. The Ministry of Shipping has initiated the construction of Inland Port near Ramnagar, Varanasi and which proposes to opens various new dimensions of regional economic growth of ancient city. The proposed Multi Modal Terminal at Varanasi will be set forth a major logistics gateway of north India connect to the whole world with trade through river and sea routes. Varanasi will be known for multimodal hub for logistics where railways, roadways, airways and waterways connectivity are available at one place and creation of this new trajectory boosts economic development within the vicinity of River Port, the transport model is not limiting to logistic hub a world class freight village and SEZ Infrastructure development is proposed here.¹⁷



(Fig. No.49. Photographs of traffic movement along Can't Railways Station, Varanasi, dated 06.12.2019)

¹⁷ Photographs of traffic movement along Can't Railways Station, Varanasi, dated 06.12.2019

2.7 Present Cargo Transportation Scenario:

Presently India's logistics cost is 18 % of total GDP and most of the developed countries in world have bring down their logistics cost up to below 10 % and the European countries transportation cost are already at 13% of their country gross expenditure budget.

National Waterways 1 together with the proposed Eastern Dedicated Freight Corridor (EDFC) and a number of National Highways (NH-1, NH-2, NH-80 etc.) constitute the Eastern Transport Corridor of India, connecting the National Capital Region with Kolkata, the seaport gateway of India to the Bay of Bengal

Indian Railways and Roadways combined transport modes carries total 90% of the freight volume in the country that results for increasing pressure on existing transport infrastructure, at present the shipping sector has only contributing for 6% of cargo transportation in the country and majority of Indian ports are already reaching to their existing throughput/handling capacity.

It is estimated that the annual freight flow through this corridor is about 370 million tons. The total freight flow generated from or destined to the six States in the corridor is about 40% of the overall flow of cargo in India.

Varanasi has a locational advantage, as it has a vast agrarian hinterland with proximity to NH-7/NH-2 and EDFC which opens up vast opportunities in inland sector as well as ex-India movement of cargo through this transport corridor

Indian government is religiously focussing to reduce the total logistics cost from their budgeted expenditure and putting tremendous impetus on creation of Inland and costal shipping transportation infrastructure

Under flagship scheme of Sagarmala programme government is putting efforts for creation of Inland Waterways Infrastructure in the country and augmenting existing rivers, backwaters canal and creeks for transportation purposes.

From economic perspective Inland shipping is the most viable, cost effective and reliable mode of transportation, the strategic use and shift of freight from Roadways and Railways to Inland waterways routes resulting in reducing total transportation cost additionally it offers maximization of water resources utilization of country through IWT sector.

The official data of government says shifting of cargo on coastal and inland shipping can save the total cost of \$2.5 billion by FY 2025 and the IWT sector will be promising modes of transport in coming years.

Transportation of bulk commodities like Coal, mineral ores, fertilizer, stone chips, cement, food grains, containers and Over Dimensional Cargo can be easily moved through the routes of National Waterways.

Presently freight transportation with IWT modes is underutilized but over development of waterways will offers transportation modal mix in India and shipper can strategically manage their freight movement at lower cost.

National Waterway 1 the total length is approximate 1600 Km from Allahabad to Haldia and covering the Ganga – Bhagirathi – Hooghly River system. Four Indian states are directly benefited and it covers the major 42 economic and traffic regions.

Varanasi hinterland is within the catchment area of National Waterway 1 and large number of industries are located in adjoin district of Varanasi city which includes the industries like Cement, steel plants, sugar mills, thermal power plans, textile and food processing units etc.

Besides the various industrial cargo Varanasi region frequently transported agricultural goods, natural resources, trade goods and transshipment cargos etc. within its catchment area of NW-1

IWT modes of transport using the multimodal transshipment of cargo from one mode to another mode will save the cost of logistics and offers greater environmental benefits by reducing the carbon emission.

Varanasi region has frequently transshipment of variety of goods for north eastern region and this location has strategic juncture of passing of north Indian states cargo to the eastern and north-eastern states of India.

While conducting the interviews with local chamber of commerce it was identified that the Varanasi catchment area has potential for viable shipment option by means of IWT routes. As the specific handling of cargo at lower cost and requirement of storage facility is highly needed, hence the development of MMT along with Freight village at Varanasi will offers the more comprehensive logistics concepts for the business supply chain solutions.

Global Scenario & Modal Share of Traffic on Inland Water Transportation Sector¹⁸

<i>Country</i>	<i>Length of Inland waterways (Km)</i>	<i>IWT share (Million Ton Per Annum)</i>	<i>Modal Share of IWT</i>
<i>China</i>	123,000	1100	8.7%
<i>Vietnam</i>	42,000	210	48%
<i>USA</i>	40,000	615	8.3%
<i>European Union</i>	35,000	565	7%
<i>India</i>	21,000	33.32	0.5%

Source: World Bank, JICA, IWAI

The commercial cost of cargo is directly affected by the transportation cost hence the economical and viable models of transport offers cost economic benefits.

Varanasi city is located at strategic geography which lies in middle part of the country from Eastern India to Western India that broadly attributed for the factors of organised growth and unorganised growth, the city has prospect of large economic growth due to strategic transshipment trade goods here, in large most of the companies are planning to establish their cargo and warehousing hubs at this location to caters the large market of Northern region of India.

Varanasi has prospect of development of cargo aggregation and transshipment hub

¹⁸ Report of World Bank, JICA, IWAI

Due to multimodal choice of transport facility increase probabilities of investments to be made in setting up of the industries in primary hinterland of Varanasi Multi-Modal Terminal neighbourhood

Efficient logistics system improves the lives of rural population and generate more employment opportunities.

The logistics cost is largely depended upon the types, volume and nature of commodity and the economics of freight transportation inversely proportional to the cost and savings, usually transportation of larger lots of cargo in same voyage will offers the higher economic cost savings.

The above picture shows the origination and destination of the cargo from the catchment area and the northern plains are highly populated region in the country and this region caters the need of 50% populations in India.

This region is fortunate enough to receive the water economic benefits from the Ganga basin from Gangotri glacier to Sagar and Sunderbans delta, while being plan region the roadways and railways modes are already well established in the region but increasing demand of the transport of cargo and constraint of land acquisition along with rising construction cost of infrastructure will suffering the overall performance. The rising pressure on existing transportation infrastructure imposing various related cost, hence the utilization of Inland Water transport in this region can offers the greater cost savings in long run. The concept of IWT based transportation will offer the opportunity to get relive of capital expenditure from surface transport and the networks of NW1 and NW2 will offers the easier connectivity with north eastern region. The shipper can easily plan their economic and environmentally friendly vessel transport voyage.

IWT has competitiveness of carrying larger volume of voyage with minimal efforts and lesser fuel consumption leads to reduction in the emission of carbon foot print. River Ganga – Bhagirathi and Hooghly are NW-1 and further connecting with NW2 River Bharamputra through sunderban delta and IBP routes will offers higher degree of flexibility for multimodal shifting of cargo loads.

Varanasi has on strategic juncture where the distribution networks established for diversion of cargo movement directions happens and here transshipment facility for IWT modes frequently widespread the IWT economics

Presently most of the trucks on the road are playing with overloaded cargo in-order to reduce the cost of transportation, the smaller loads and smaller shipments kills whole economics of the shipment, hence the using IWT vessels with 2000 MT will be reduced down the cost and efforts.

Accommodate the 10% of cargo movement in future if necessary navigable infrastructure will be developed.

2.8 Need for Developing River Ganga as National Waterways-1 For Transportation Purposes: ¹⁹

Indian Transport sector are large and diverse it caters the need of more than 1.1 billion needs of peoples, the transport sector is contributing the big slice in the GDP growth of the country,

¹⁹ Ministry of Statistics and Program Implementation, Govt. of India

good connectivity in urban and rural areas are essentially required for economic growth and development, since last 10 years India has witnessed the huge demand in the development of transport infrastructure and services.

However, the already existing modes of transports are about to reach at saturation stage in coming 10 years and will not be able to keep the pace with the rising demands and may be proving to be a drag on the economy hence transportation sector requires major improvements to support the country continue the economic growth and reduce the poverty.

Roadways: In Transport sector roadways are always dominated due to its seamless connectivity with first mile and last mile transportation, presently almost 85 percent of passenger traffic moving on roadways and 60 percent of freight traffic catered by the roadways. The density of Highway Network in India is 0.66 Km of roads per square Km of land. Which is much greater than from other countries China (0.16), Brazil (0.20) however the most of the Indian Highways are narrow and congested with poor surface quality and approximate 33 percentage of Villages in India do not have access of road networks.

Railways: Indian Railways are the one of the largest railways under the single management and carrying approximate 19.8 million of passengers every year and approximate 2.4 million tons of freight are carrying yearly. The railways is under vast demand of passenger and freight transport requirement, however the major corridors of the Indian railways are capacity constraints and requiring the capacity enhancement plans.

Aviation: India's having total 128 airport at present and yearly handling 142 million passenger and 1.60 million tons of cargo approx. and CAGR of passenger growth of 14 % and freight 7% was observed over the base year respectively. There is drastic increase in the air traffic project for annual growth of 15 % will be possible in pessimistic scenario.

Ports: India has 13 major ports and 199 minor ports along its coast line of 7500 KM and catering the seaborne trade of 67 % of the total value. Port has played a significant role in improving foreign trade in the growing economy and Indian ports are handling approximate 850 million tonnes of cargo and future potential of port sector are huge and

Inland Waterway: Inland water transportation also remain largely under developed despite India having 14000 kilometres of navigable rivers and present government has taken various initiative for its developments under SAGARMALA an initiative of port led development.²⁰

Inland waterways authority of India is an autonomous body under Ministry of Shipping and this agency assigned the responsibility for implementing the prestigious Jal Marg vikas project for capacity augmentation and fairway development National Waterway -1 for utilising river water for transportation purposes and this project also ensure the development of river Ganga on priority basis. The analysis of the economic viability of the IWT sector is already done by the international consultants. At present eleven thermal power plants are operational along National Waterway - 1 and ten more project are coming up, the existence of thermal power plants and availability of coal is the one of the major commodity envisaged to be transported by using National Waterways -1, apart from the coal, construction material is another major commodity which will be transported to aid construction industries in the major cities like Varanasi. National waterways stretch passes through very fertile land therefore there is an

²⁰ National Shipping Board, Govt. of India, web link: <http://nsb.nic.in/content/>
Official Portal of Sagarmala, Ministry of Shipping, Govt. of India,
Web link: <http://sagarmala.gov.in/>

opportunity for transportation of agricultural aggregates to the developed market place and provide best MSP to the farmers of the hinterlands.

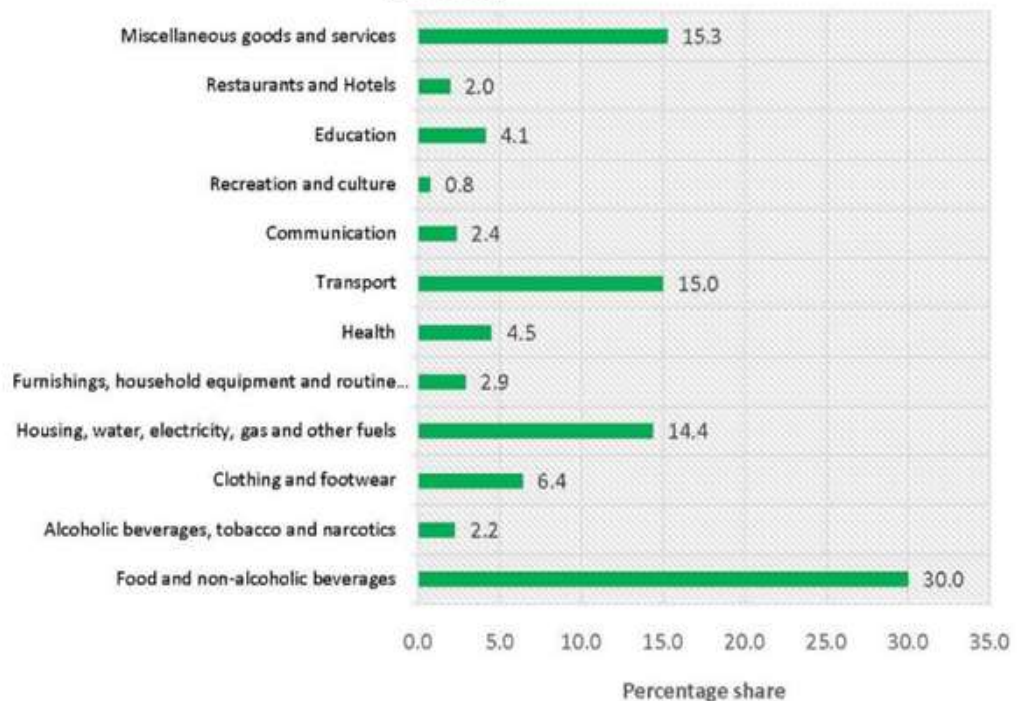
The developments of multi modal terminal at Varanasi will opens the doors of various economic investments opportunities and offers various economic benefits, IWT sector has tremendous potential and become the economic game changer of Varanasi.

It was observed that the countries like Vietnam, China, USA and European Union has already strengthen their Inland transportation system and the countries like Vietnam is transporting 48 percent of their total annual freight of country with IWT mode. Hence this above table shows how important for India to develop IWT sector for transportation of Cargo by utilizing the river waters.

Reference to the statistical data published by NSSO & Ministry of Shipping has defined the percentage share of various sectors under the private final consumption expenditure for financial year 2016 – 2017.

The percentage share of expenditure on transportation sector is around 15 percent of total expenditure which is bigger in slice. Most of the developed countries globally the maximum consumption expenditure on transportation is 10 percentage and below, hence the efficient and cost-effective transportation is highly required for India. Development of Inland Waterways Transport system may help to achieve the target and also meet the future demand of cargo handling capacity

Percentage share of various items in Private Final Consumption Expenditure in FY 2016-17 (at current prices)



(Fig. No.50. Source: Ministry of Statistics and Program Implementation, Govt. of India)²¹

²¹ Ministry of Statistics and Program Implementation, Govt. of India

2.9 Environmental Economic Advantages of Inland Water Transport:

It is established that water-based transportation consumed lesser fuel as compared with any other surface modes of transport and due to less friction and available bouncy the larger and weighted cargo easily transported through water and sea routes.

Inland Water Transport mode consume least fuels and consumable which directly supports the reduction in depletion of usages of exhaustive resources by saving fuel.

Inland Water Transport reduces the pressure of surface modes of transport by accommodating the larger amount of cargo due to that the fuel consumptions were saved and also occurs the lesser emission of Hazardous gases.

IWT modes reduces the carbon foot prints and adopted the renewable source of energy life solar powered vessels in use on waterways.

The government is putting their efforts to make the river Ganges as all-weather river transport and the river connects with rural India to the main course of economic life. IWT mode is the only one course of transport which is aligned with nature cycle called flood and monsoon.

With adoption of new technological Inland Ships, the method of using Dumb Barge along with the combination of Push Tug vessel will enhance the utilization of fuel and make the IWT mode as economic modes of transport facility.

Another bigger advantage of developing Inland Water Transport is the requirement of minimum land hence there is lesser disturbances on ecology and biodiversity, as the requirement of construction is also limited with IWT mode of transport.

The river Ganga is connected with most rural areas of the country and developing the water routes in form of National Waterways the majority of population will get benefitted, mostly the hinterland of Ganga basin is fertile land and lots of agricultural activities are well carried out here in this region and the river transport facility will improve the livelihood of poor farmers by giving right access of transport and storage facility directly from their farm land to market place.

Indian is building green waterways and adopted the strategy to avoid or minimized the environmental damaged to the all-possible extent, Inland Water Transport is working on the principal of “Working with Nature” which minimal impact on aquatic life and climate conditions. This project is also spreading the awareness and giving training programme for making eco-friendly waterways for transportation.

2.10 Inland Water Transportation Impacts to Improve Business Efficiency of Varanasi

Varanasi region has many industrial and manufacturing setups which serving the needs of north eastern markets and vice versa, there are numerous of different cargo types which are transported within the catchment area of the district, similarly the regional market insights gained the economic importance of sustainable and reliable transport modes.

There are many promising viable Origin and Destination pairs are identified and characterized for continuous flow of the cargo, the development of IWT sector attract various investments in form of terminal infrastructure and creation of Special Economic Zones (SEZ), riverine port on Ganga facilitate growth of trades in the region by offering viable and cost efficient

transport modes at Varanasi and spontaneously the region becomes logistics hub of north India region as trade cargo are generalised here and get differentiated its flows from here onwards. The potential shipper may take other aspects of sheer cost advantage into consideration while deciding different modes of transport options.

Inland Water Transport service on NW-1 will gradually take up the large number of cargos as the hinterlands of NW-1 falls in between the Amritsar to Kolkata Industrial corridors linking of IWT will boost the cross borders trades and offers seamless connectivity with North East regions of India with Kolkata as well as Bangladesh. The waterways will provide support to the unorganised business sector by promoting smaller trades across the river markets. More numbers of Origin and Destination pairs will be created thus resulting in investments in loading and unloading of cargo business, warehousing and cold storage facility wherever required.

Inland Waterways enhance connectivity along the hinterlands of river Ganga and generate business opportunities, developing feeder routes connecting to national waterways may improves the trade cargo movements especially in rural areas.

2.11 Economic Growth by Catering Demands of Logistics Needs with IWT Sector:

Varanasi city is accelerating manufacturing-based trade growth hence there will be rising demands for logistics for supply of raw materials and finished goods and in present situations the major logistics moved from Varanasi is through model share of Railways and Roadways and there is lack of integration of multiple modes of transports. As per the national economist estimations the GDP growth of India will increase threefold times than the present rate and the current logistics networks will be insufficient to handle the increased freight movements over the coming decade.

Inland Water Transport integrate with Railways and Roadways and make the optimal utilization of freight infrastructure, at Varanasi the Multimodal River port integrate the transport mix and define the IWT route where many shipping companies operate their modern and economic viable vessels in the Ganga River.

National Waterways corridors having very economic high potential the agrarian society along the river Ganges are very productive and fertile, hence these hinterlands in future becomes a load centre where inbound flows of fertilizers and agricultural equipment's will be transported and there were immense possibilities of outbound trade of goods like poultry meat, wheat, rice, sugar vegetable and other agricultural produce.

Inland Waterways connects to the costal hinterlands along the river Ganges with are under connectivity and least important considered till dates, the development of Waterways will increase the importance of river lands and produce will be transported easily on these routes.

Railways are also developing the Eastern Transport Corridor to improve the logistics performance of the country regarding freight flows along the river Ganges by integrating with IWT modes and this unique coordination of logistics movements with two different modes of transport reduces congestions on roadways and railways.

Since our historical transport corridor Grand Trunk Road build from Delhi to Kolkata is established freight corridors since from past, connecting National Capital of the country with Kolkata crosses over the six states and serves the logistics demands, hence National

Waterways – 1 originates from Varanasi to Haldia having potential to become a gateway of trade with North Eastern region, the proposed waterways corridors enhance overall capacity utilization of the established industries at Varanasi.

IWT along with storage infrastructure will address the issues of high tariffs and also encourage the better utilization of National Water resources in transport, the various Market forces progressively helps to create economic incentives for private sector participation.

Key demand of transport services needs to match the market needs, the National Waterways corridors from Varanasi to Haldia has substantial flows of freight, the other significant demand side of transport clustering the various opportunities for small and medium scale enterprises it helps the industries for consolidating volumes of cargo and offers benefits from the economic scale of transport.

IWT will connects the rural hinterlands with nearby urban markets and helps in creation of warehouse and distribution networks in the Varanasi and nearby surrounding districts located along the bank of river Ganga.

Varanasi is the strategic locations which is in mid of the geography of the country in between East and West and with presence of IWT river port here become transshipment nodes for railways and roadways and the shared vision may evolve the regional transshipment hubs and Inland Waterways Port will connect the region globally.

2.12 Inland Water Transport Nurturing Tourism Business at Varanasi: ²²

River Ganga is holiest ever river as per the Hindu mythology it flows through many places since from its origin to the end, River Ganga is not the river it's the sentiments of Hindu communities, the Importance of river is not limited up to the for pilgrims' purposes but there are many possibilities for economic development were associated with it.

At Varanasi River Ganga is the major attractor of tourist and most of them visiting near banks of Ganga experiencing various holy activities and takes participation in the ethnics, rituals and cultural activities etc., the development of Ganga Ghats along with water sports facility may enhance the experiences of Visitors. Inland water-based transportation system allows to the commuters to make Darshan of Ganga Aarti conveniently and helpful in creating the memories of experiencing the city differently.

The Ghats of the Ganga are real asset of Kashi or Benaras city, the river front has been developed for thousand years ago and presently the city is using more than of 88 Ghats for spiritual purposes & ceremonies purposes, various religious gathering and Banarasi Haat are established in the lanes connecting to the river front which provides the essence of commercial activities.

²² The Varanasi Heritage Dossier/History and Development – Wikiversity, dated 1/5/2020



(Fig. No.51. View of active cremation site along the Ghats of Ganga at Varanasi)

The Harishchandra & Manikarnika Ghats are used for the cremation of the dead bodies for Hindus which has sins that it gives freedom from the cycle of birth and re-birth etc. The development of Inland Water Transport systems at Varanasi adds some vibrant changes for development of tourism Industries in the city, the pre-existing of tourist attraction sites are prerequisites for development water-based tourism facility here, IWT transportation facilitates to connect the nodes of market, heritage sites, religious places and tourism destinations, which enhance the mobility of passenger for commuting and saves time and cost.

As river front of Varanasi is the centre of trade, commerce and tourism hence the upcoming water-based transportation provides opportunities of economic development by increasing in the ridership on IWT modes.

Inland waterways transportation will establish ferry Ghats and create networks for multi-mobility of passengers and offers connectivity with regional traffic with urban core of the city.

Under smart city mission government is putting their harden efforts for development of tourism infrastructure to capitalize the potential of tourism inflow.

As per the 10 years analysis of tourism data of UP tourism department reflects there was approximate more than of 50 lakhs tourists have visited to the Varanasi city and expected for general increase in the tourist traffic.

Hence development of Ferry or Inland Water based transportation relatively increase the income of the residents of the Varanasi people, these factors will enhance the socio-economic development of the people.

During the monsoon seasons the local commuting are possibly hinders for the regional public hence efficient water-based transportation system essentially promotes year-around passenger's mobility.

Ganga river front is the major attractor for tourist at Kashi, the upcoming multimodal transportation facility provides gateway for multi-modal passenger access which is the safe and convenient in long run, and Inland water transport offers incremental economic benefits to regional populations.

In future advanced ferry services provides multiple access to the city core sites that's greatly promotes development of MSME sector, trade development & business development in the region.

The Varanasi city serves as regional market for various adjoining districts hence during the monsoon seasons most of the hinterlands were disconnected with the main cores of the city. So, the functional development of National Waterways 1 and integration of river transportation facility with existing paratransit modes of transport will provide efficient connectivity to the various hinterlands through boat services and helps to achieve ultimate goals of regional economic development.

The Government is planning to utilise the river water resources for development of Varanasi region by improving socio-economic characteristics of populations, increasing employment rate with associated sectors with water transport, focused on improvement in the annual tourist foot fall etc.

Varanasi is the city which is the globally attractor as locations for spiritual and pilgrimage and development of water transport facility in the region improves the reach of visit of the tourist.

²³Both sides of river bank at Varanasi have locational advantage the IWT Multi-Modal Terminal creates higher proximity of tourist ridership, the tourist spots located such as Ramnagar Fort, Sant Kabir Math, Archaeological Survey of India Sites, Ganga Ghats, Temples and Religious Centre of learnings attracts Tourist and armatures of scholars to the city, by channelizing new water transport facility along with unique sites of tourism attractions can provide the sizeable amount of ridership. Along with the transportation facility to be developed at Varanasi the other water related leisure activities may be promoted by development of Marina near the hinterlands of Varanasi Ghats, the Marina may be developed at Varanasi where in the small space leisure craft can moor where Passengers and embark and disembark and the Ganga River front can be developed as suitable destination of leisure activity and boost the tourism sector and local economy.



(Fig 52. No Photographs taken during Field Survey on 18.09.2019, local country boat operators at Varanasi have been developed small marina type facility for tourists to witness the glory of Ganges Ghats at Varanasi)

²³ Photographs taken during Field Survey on 18.09.2019

2.13 IWT Sector Enhances Development of Heritage & Cultural Sites at Varanasi: ²⁴

Varanasi is the oldest habitat of cultures, religion, education, philosophy, tourisms, trades, Industries and commerce, the city is located along the left bank of Ganges basin in the state of Uttar Pradesh and best known as city of holy shrines “Kashi”, since centuries Kashi Benaras is Moksha Dham and popular pilgrimage for Hindus, this land is having one of the Shakti Peethas and belief presence of one of the twelve Jyotir Linga. As per Hindu believes system individual dyeing & cremated here gets instant gateway to liberation from the cycle of birth and rebirth.

Getting holy shrines at Heritage city under the adobe of lord Shiva washes all the sins, doing regular chanting mantras, making sacrifices and doing charity reaps you the reward of lifetimes.

Kashi or Varanasi is ancient living city with heterogeneous religions scared holy places for Hindu, Buddhist, Jain and Muslim. The city of temple is famous centre for music, art, crafts, education and learning. Here the culture is deeply rooted among the life of people and Ganges River has religious importance, sentiments and belief systems.

Banaras is the city of culture canvassing the spirit of tradition and culture located at the latitude of 25°.18’ N and longitude 18°1’ E on the bank of River Ganges. The city has numerous of temples and most venerated temple is Kashi Vishwanath which is dedicated to Lord Shiva, Durgakund the temple known for swarms of monkeys that inhabit near the large trees, the Mosque of Aurangzeb is prominent religious building for Muslims, Tulsi Manas Mandir and Vishwanath Temple BHU is important and modern temple present here and few miles away in north of Varanasi city Buddhist monasteries and temples are situated at Sarnath world heritage sites of Buddhism religions.

The temple is dedicated to Lord Shiva and it is one of the Jyotirlingama of the twelve, structure is built in the period of Gupta and it was destroyed and re-constructed many times, the last structure was demolished by Aurangzeb and in 1777 the current structure of temple was built by Maharani Ahilya Bai Holkar of Indore.

2.13.1 Ganga Ghats World Heritage site at Varanasi: ²⁵

More than 88 Ghats are located along the river front of Ganga and this becomes a tangible asset of the cultural city Varanasi, here Ganga River flowing from south to north directions in crescent shape is the unique in world, as per Hindu mythology this place has religious importance where lord Shiva himself and Shakti his wife resides in this city.

Kashi Banaras is the older than the history, tradition and legends there is almost more than of 100 Ghats where Puja, rituals and bathing are done. The Ghats provides peace of minds from the tranquillity of the city, the confluence of river Assi and Varuna bathing here gives holy shrines offer their prayer to the lingam erected in his name.

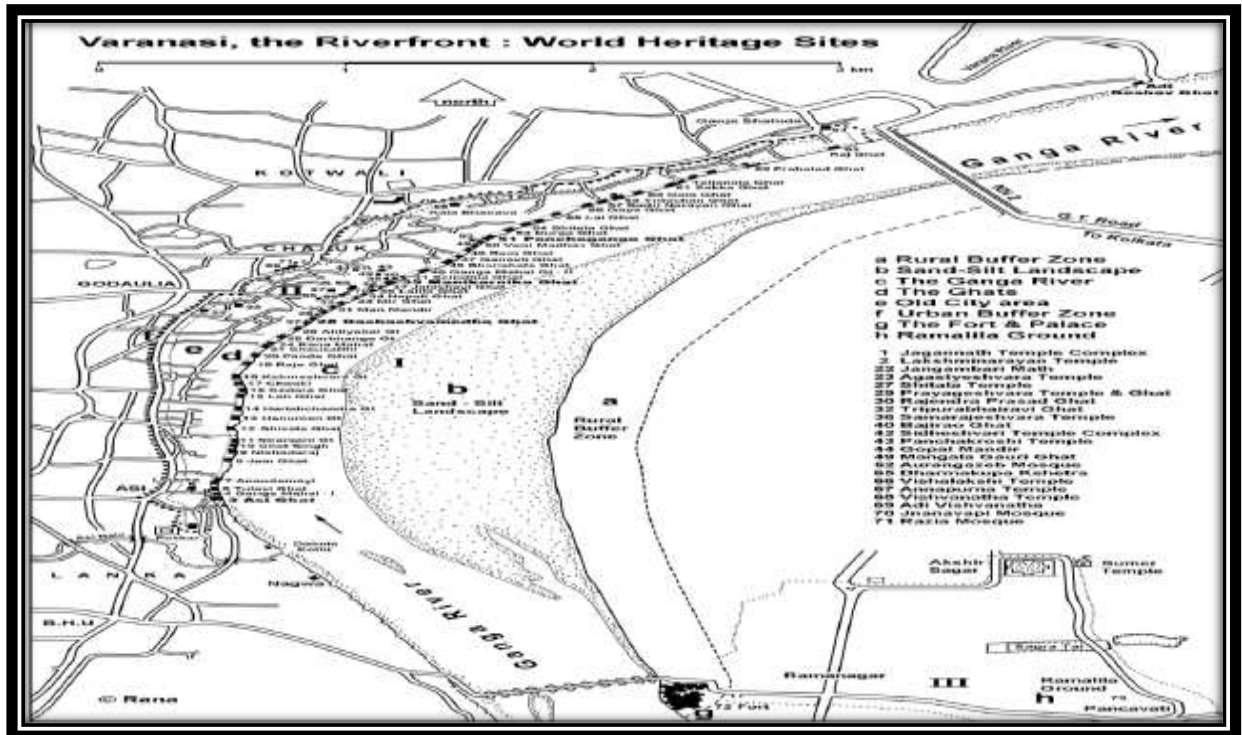
Every Ghats of the Varanasi has its history, Ghats were the identity of the city, Manikarnika & Harishchandra Ghat are active crimationation site, where whole day the dead bodies are burnt, Dasaswamedh Ghat is the heart and soul of all Ghats where vibrant crowd finds in the evening, daily Ganga aarti are done in believed that Barhma created Lord Shiva and welcomed him

²⁴ The Varanasi Heritage Dossier/History and Development – Wikiversity, dated 1/5/2020

here, However Darbhanga Ghat is photogenic of all and responsible for commercialization of the city. Kashi is ultimate pilgrimage spot of Hindus since millions of year's ages.

Kashi Vishwanath is addressing as Golden Temple and one of the most famous temple located at western bank of the river Ganga, deity of the temple is known as Vishvanath means ruler of the universe.

This pilgrim offers SANKALP or STATEMENT OF INTENT for panchtrith yatra before commencement of the journey, Vishwanath Mandir.²⁶



(Fig No.53. Source: Singh Rana P.B. 2018. Urbanisation in Varanasi and interfacing Historic Urban Landscapes; <https://banaras.academia.edu/RanaPBSINGH/Papers> OR https://www.researchgate.net/profile/Prof_Rana_Singh)



(Fig No.54 Glimpses of Ganga Ghats at Varanasi)

²⁶ Singh Rana P.B. 2018. Urbanisation in Varanasi and interfacing Historic Urban Landscapes; <https://banaras.academia.edu/RanaPBSINGH/Papers> OR https://www.researchgate.net/profile/Prof_Rana_Singh

13.2 Tulsi Manas Mandir:

Temple is dedicated to the Lord Shri Rama and it was constructed by Surekha Family of Varanasi, the temple has depicted the various epic scenes of Ramcharitramanas and the museum present here are having rare manuscript of the Ramayana.



(Fig. No.55. View of Tulsi Manas Mandir, Varanasi)

2.13.3 Sankat Mochan Mandir:

This holy place is dedicated for Lord Hanuman and located in the southern part of Varanasi, it was considered that this temple was built since the time of Goswami Tulsidas, Lord Hanuman is very powerful avtar of Lord Shiva, he was the son of Wind and Mother was Anjana Devi, the Lord Hanuman is Karma Yogi and extraordinary Brahmachari. This holy place is one of the oldest religious place in the city.



(Fig. No. 56. View of Sankat Mochan Mandir)

2.13.4 Durga Kund:

Temple is dedicated to the Goddess Durga, the structure of temple was built in 18th Century, the Kund located near to the temple that enhances its view. As per believes of Hindu Mata Durga is incarnation of the Shakti or Female power, the Mata Rani is dressed in red colour and having ride of tiger, the goddess is reflect of Shiva & Vishnu trident.



(Fig No.57. View of Durga Kund, Varanasi)

2.13.5 Sarnath:

Post enlightenment at Bodh Gaya Lord Buddha went to Sarnath where he has preached his first discourse and set the Wheel of Dharma, Sarnath is the one of the most pure and holy places, here Buddha has encountered the five men and who has been his companions of earlier austerities.

Buddha has prescribed eight-fold path and four noble truth and the Monastic traditions are flourished here over 1500 years, at this site Ashoka has erected a column 15.24 m in height which has



(Fig. 58. View of Dhamekh Stupa, Sarnath, Varanasi)

headed with four lion and it symbolises the imperial rule and the lion is adopted in our emblem in Indian republic.

Dhamekha Stupa has the inscription written in Dhamekha words this is the spot where Gautam Buddha has delivered his first sermon, Dhamekha stupa sacred place where voice of Gautam Buddha was heard firstly many dignitaries of Buddha from all over the world comes at Sarnath for circumambulation the stupa and worship Buddha.

2.13.6 Banaras Hindu University:

Banaras Hindu University is the capital of Knowledge in the city, this 100-year-old educational institution was founded by Pandit Madan Mohan Malvia in 1916, and the university is built on 1300 acre of land donated by the Kashi Naresh and presently located in heart of the city, thousands of scholars are getting higher education here.

Presently university has 140 departments, 3 institutes, 14 faculties, 4 interdisciplinary centres and various schools and colleges for women.

The university is promoting Sanskrit Literature, thoughts and cultures of Hindu, enhancing learning and research of Art & Science combined with necessary practicable training which indigenous to the development of country.



(Fig No.59 Banaras Hindu University, Varanasi)

2.13.7 Ganga Aarti

Mighty Ganga is holy river, every day the Ganga Aarti activities are seen along the various Ghats of the Varanasi city, this aarti is shining beacon of devotion of bliss and spreads divinity around the surroundings, thousands of devotees across the city reaches to participate in this spiritual activities along the water front of the river Ganges, the pundits and Vedas and Upanishads were involved in the performing of this aarti and this activities was headed by the Gangotri Sewa Samiti, a multi-layered brass lamp was lighted and well synchronised rhythmic chanting of mantras were done by the priests, blow of conch shells sanctify the atmosphere and devotees waving the incense stick to worships Mother Ganga. The smell of camphor and goose bump-inducing aarti spreads purity in the air. It's a wonderful event where thousands of tourists arrived to witness it.



The development of Inland Water Transport facility will boost the tourist & passenger footfalls near river front, whereas the enhance IWT infrastructure supports various economic activity by generating more boats riders leads to the rise in the income level of Nishad and fisherman community.



Varanasi city is known for its cultural and heritage property, the heritage construction of wide river front and various holy activities were carried

(Fig No.60 View of Evening Ganga Aarti, Varanasi)

along the Ganga Ghats makes the city more prominent, every Ghats has its own history, Varanasi is the holy centre and cultural capital of India, the city has four dhams

in the four cardinal directions i.e Badrinath in the north, Jagannath Puri in the east, Dvaraka in the west and Rameshwarm in the South have re-established Varanasi in arch type formations Matha Ghat represents Badrinath dham, Rama Ghats represents Jagannath Puri, Shankudhara Ghat represents Devarka, and Mir Ghat represents Rameshwarm etc.

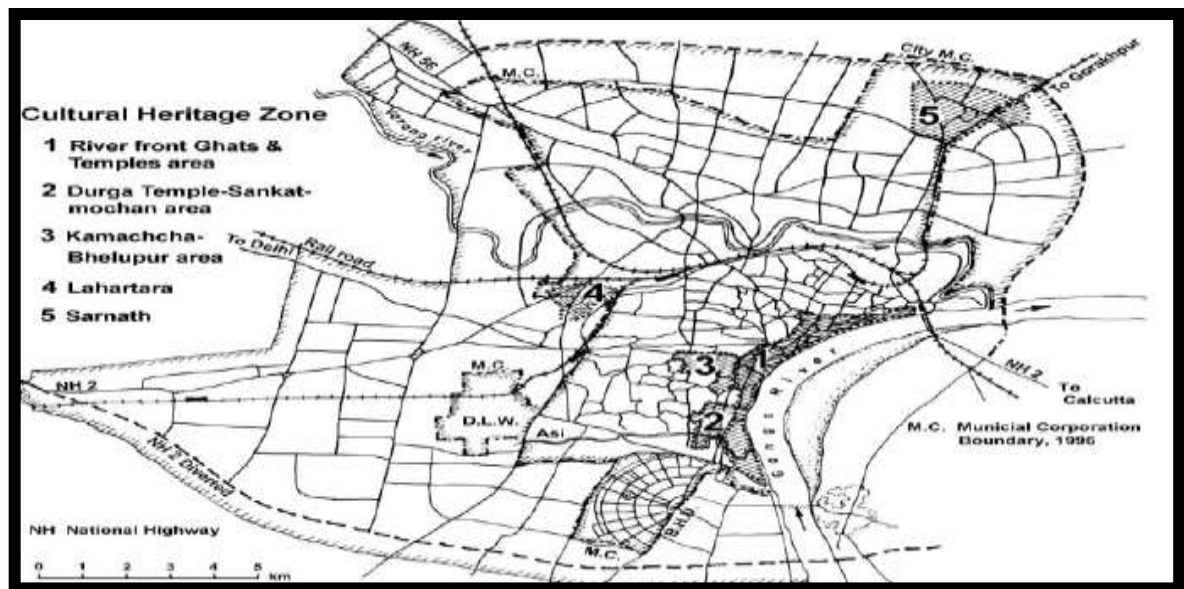
The city has also conceived the other religious cultural places in it Kedar Ghat represents Kedarnath Dham, Bakaria Kund or Nakkhi Ghat represents Mathura, Dashwamedh Ghats represents Prayag Raj, Kamacha Ghat represents Maa Kamakhya Dham (Assam), Kurukshetra Kund near Mann Sarovar Lake represents the Mahabhrat epics and Kurukshetra, along with Hindu cultural heritage, the city is known for the pilgrimage for Buddhism at Sarnath, Jainism and Muslims for Gayan Vapi Masjid etc.

The process of Inland water transportation will promote the city heritage and cultural property and the city will more dwellers as cultural capital of India, also various commercial transition will take place.

The development of IWT transport systems along the river Ganga, Assi and Varuna emerges it as city of Port Town where existence of ancient mythologies and religious centre linked and promote pilgrimage tourisms.

The city is emerging in 8th century in between the confluence of river Varuna and Assi along the Ganga River front, the city has stored conglomerate of various ages of histories, various kingdoms, dynasty, emperors, rulers, Invaders and British has constructed the structures here, therefore the Varanasi city has known for the world largest heritage zone site and Ganga Ghat is world heritage site.

The development of National Waterways along the Ganga will facilitate the development of various economic activities along the Ganga Ghats, all together it enhances the functioning heritagescape, and the city has five cultural and heritage Zones who preserves the ancient glory of the Varanasi city.



(Fig No. 61. Map Indicating Five Cultural Zones of Varanasi City, Source: Singh Rana P.B. 2018. *Urbanisation in Varanasi and interfacing Historic Urban Landscapes*; https://banaras.academia.edu/RanaPBSINGH/PapersORhttps://www.researchgate.net/profile/Prof_Rana_Singh)²⁷

2.14 Lead Economic Gains Achieved Through Inland Water Transport:

Water transport modes has huge potential and spectrum of economic benefits by reducing logistics cost, de-congesting existing road and rail traffic, promoting green transportation, reducing accidents and other hazards etc.

²⁷ Singh Rana P.B. 2018. *Urbanisation in Varanasi and interfacing Historic Urban Landscapes*; https://banaras.academia.edu/RanaPBSINGH/PapersORhttps://www.researchgate.net/profile/Prof_Rana_Singh

In developing world, the mobility is the tacit requirement of economic clusters and industries where well-planned mass transportation system benefits to the all sectors of the economy.

IWT is commercially viable non-polluting cost cutting and extended geographical reach distributional faraway network that supports logistics demand of MSME clusters and industries located along river Ganges.

Apart from the multiple tangibles benefits the IWT sector indirectly impacts on day-to-day life of the populations living along the banks of river Ganga, the interest of millions of people is attached with river and it was sound understandings Ganga has important attributes in changing the lives of the regional populations.

The following clear advantages drawn through developing Water Transport modes in Varanasi regions:

a) **Reduction in City Traffic congestions:** Varanasi has dense urban settlement with narrower lanes and lesser wider existing roads, there are minimal chances of development for any new infrastructures and most of the settlements were heritage and protected sites by Archeological Survey of India (ASI). The development of IWT modes of transportation system supports city traffic movement by offering alternative modes for commuting the regional populations through routes of Ganga Waterways, at Varanasi water transport facilitate more convenient transit trips as compare with road vehicles.

b) **Improves Intermodal Connectivity:** The city serves as the centre of market, business centre, healthcare needs, educational institutions, Government offices, courts, tourism and cultures etc. for the region hence there is mass regional movement of traffic happened in the city and most of the existing roadway's corridors of the city is very congested and overcrowded. The Inland Water Transport modes gives the positive support in mass transit movement and offers the better and faster connecting links. The regional populations takes the routes of Ferry transit system and easily commute to the city in centre.

c) **Promotes city heritage value and encourage development of river waterfront:** Since from the ancient ages the river front of Ganga at Varanasi has spiritual advantages, entire Gangetic basin populations are meeting their needs form mighty river. The development of water routes on river Ganga with help ferry vessels encourages intermodal connectivity and also facilitate transit-oriented development of river water front. The waterways corridors may become driving factors of economic growth of the region in coming years and additional traffic movement demands can also be met by this activity.

d) **IWT sector may become Job creator in the region:** The majority populations living in the region are extended to middle-and lower middle class reach and the population is depended upon the small-small commercial activity, IWT sector will strengthen the efficient supply chain management system of the region and opens the opportunities of MSME sector to grow their business by smooth transit movement of cargo etc. Geographic wide reach is developed with help of efficient IWT sector and major industries will have opportunities to setup their facility in the Varanasi region that results for enhancing the economic trades of the region and resulting for creation of millions of different types of jobs.

e) **Promotion of Tourism and Spiritual and Recreational activities:** Benaras is known for the city of temples and centre of thousand year's cultures and every year's millions of tourists and visitors are arriving at Varanasi for visiting the city and experiencing the cultures and enjoying the cushion etc. Ganga river front is the major centre of attraction for the visitors and tourist of the region, development of National Waterways 1 will encourage for promotion of tourism and facilitate the existing spiritual activities along the Ghats of the city.

f) Time saving & Emergency Response Management: IWT fleet of vessels were deployed in the river for transportation which saves good amount of time of transit population moving towards the city for meeting their needs and also helps to reduce the city traffic up to certain limits. IWT modes of transport may deploy the certain specific vessels which can meet the emergency services response such as flood management, electrical grid failure and water ambulance services etc.

g) Ferry Water Ambulance Service:

The Government has introduced the Ferry Water Ambulance service (Jal Ambulance Sewa) for local populations living along the hinterlands of river Ganges near vicinity of Varanasi city, the Water Ambulance service offers seamless connectivity along with all ICU facility for the patient's transportations. Initially this is under development stage and the ferry water ambulance is in use for transporting dead bodies.

Varanasi city is regularly facing the traffic jams and congestion issues and for Ambulance services in emergency reposes it is very difficult to manage to make local populations to reach hospital within time.

This water ambulance service will not only benefit to the local public of Varanasi city but it also benefitted to the community living along the banks of river Ganga.

Inland Water Transport mode has facilitated the initiation of Ferry Water Ambulance services to address the present problems of emergency health responses, the Modi Government has inaugurated this service on 22.09.2017 and this will help to make the patients to reach on time to Banaras Hindu University Trauma Centre and other Health care Institutions.

The bypass road of Varanasi city is also congested hence under critical situations this water ambulance service will play the major role in facilitating the health care benefits to the population

Now Jal Marg has become the major economic contributor for the development in Varanasi regions, the water ambulance is equipped with all facilities such as emergency services with oxygen cylinder, an mobile ICU along with Emergency Medical Technician. In coming future with development of National Waterways it will also have the labour room facility.

And this water ambulance service will be given by the Govt. free of cost to benefit the local population and this facility is run by the team of NDRF, this Jal Ambulance provide the To-Fro services from one Ghats to another and saves the crucial time of patients during emergency situations.

These Jal Ambulance fleet is powered by Solar Energy which is another economic and environmental benefit. Normally for going one place to another place at Varanasi it normally takes an hour of time with roadways but initiation with Jal Ambulance service one can reach in minimum shortest time as possible and hassle free too.

Presently this fleet is under trail runs and offers free service for carrying mortal remains called "Jal Shav Vahini Sewa"

This Jal Ambulance service will be strengthened in coming future and this may serve to the populations living opposite to the bank of Ganga and other local regional community living along the hinterland of river Ganga uses these services to reach at BHU hospital for their treatment and in short time the accidents victims can be easily brought to the BHU Trauma Centre or any other hospital for treatment.



(Field Interview with NDRF Officers)



(Transportations of dead bodies with help of Jal Ambulance services at Varanasi / Water Ambulance Service birthed at Assi Ghat, Varanasi)

(Fig No.62 Development of Water Ambulance Facility along Ganga Ghat at Varanasi)

The Jal Ambulance Sewa will be the life saver service fin coming time and the Inland Water Transport plays critical role in facilitating the infrastructure of navigation and helps the country for achieving various economics heights at Varanasi.

2.15 Possibilities of Development of Floating Hospital for combating pandemic situations like COVID- 19:

We already know that Eastern Uttar Pradesh, Bihar, West Bengal and North Eastern States of India is highly affected during flood seasons and also faces health related consequences every year.

Now, whole country is struggling to beat Pandemic of NOVAL CORONA VIRUS where Railways coaches have been deployed as isolation wards and few trains have been converted into the Hospital facility.

Now, we also observing that Oxygen Trains are also running for meeting the Oxygen supply integration with Ro-Ro facility of Indian Railways.

Therefore, it is well known fact that Logistics Infrastructure plays key role in integration of resources in the country, hence India is developing IWT infrastructure therefore, such facility may be forecasted for uncertain times benefits.

However, development of floating hospital benefits mass of the rural populations, where well known healthcare infrastructure is on board to the ships and deployed as per the requirements.

Unlike in many situations of flood the NDRF Team is using floating bases for rescue operations during flood times, similarly the development of floating healthcare infrastructure act as SANJEEVANI VESSEL for tuff times.

The major problem in India is availability of healthcare facility, we need to learn from Bangladesh even after 43 years of independence history where poverty and populations is suffering heavily, the significant portion of the populations are living along the rural hinterlands and they are deprived from the medical resources.

The noteworthy initiative by establishing floating hospital facility played pivotal role in alleviating poor health conditions of the country.

Where In India the private sector medical healthcare cost is very higher and it is accessible to the limited sets of the populations. Therefore, the government investments are required in building healthcare facility in form of developing floating hospital along NW-1

In Varanasi NDRF has already deployed water ambulance facility for carrying dead bodies and patients of opposite bank, the grass root initiative is required to be taken up where basic healthcare need facility may develop and with help of NGO the focus may give on the assisting healthcare deficit.

Presently world-wide the concept has been implemented for developing floating healthcare infrastructure

Example:

Bangladesh has initiated JIBON TARI floating hospital for improving healthcare facility by integrating with Inland Water Transport.

America is origin the Boston Floating Hospital in the year 1894 as a rented boat towed along the Boston Harbour to provide maternity treatment to the mother and child, today Boston Floating Hospital in permanent building in landlocked community services centre.

In 1994, French government used retired river barge that sailed across the world and remote islands to offer healthcare services, the IWT vessel realized boat converted into the hospital, it could essentially service to millions of populations, the floating hospital project, imaging reactions of populations saw enormous boats painted white and red with doctors claiming to give medical treatment for conditions they are living with for generations.

Living with modern medicines, we know that caters health in shorter time, imagine the rural populations are enjoying benefits of medical facility unlike cities comfort of our cities.



(Fig. No.63. Emirates Floating Hospital, Hospital on Ships)

Hospital on Ships is not only a success in India where majority of populations living along the rural hinterland, the hospital ships may make impact on ensuring good healthcare for the communities living along the coastal areas.²⁸

Satellite clinics ensures that persons suddenly attacked to meet pandemic disease and rural health considerations. The need of hours is establishing ship hospital in India across all waterways. Where limited set of resources may be deployed on ships and that enables in catering large sections of populations.

Bangladesh our neighbouring country has established one project i.e RUNA KHAN that nobody believed that work could be now become more possible model for the government to provide healthcare-to-hard to reach communities.

In COVID-19 pandemic situations floating hospital may could established vaccination drive in great way, hence India is developing National Waterway-1 under Jal Marg Vikas Project where floating hospital concept is highly acceptable.



(Fig. No. 64 View of New York Floating Hospital, Source: www.floatinghospital.org, YouTube video, dated 27.04.2021)

²⁸ www.floatinghospital.org, YouTube video, dated 27.04.2021

²⁹The floating hospital of New York has been established since 150 years back, the floating hospital has thrived to revolutionized in providing healthcare facilities, the primary role of floating hospital is to provide relief to the poorest populations, relief to the marginalized labours, support locals populations living in deprived areas.

The floating hospital may act as quarantine barges in case of pandemic excursion situations, the quarantine barges including medical aids may associated with floating hospital concept.

The land-based hospitals may also be developed near to the city shore of the river Ganga, and attached floating hospital with it may leads in improving healthcare facility in the country.

The floating hospital concept provides availability of modern medical aids along the facility to the rural populations and benefit to the healthcare. The Floating Hospital may offer both physical and emotional well-being to these families living along hinterlands of river Ganga, from doctors to dentists, cardiologists, counsellors and modern medical aids may developed along National Waterway1

The novel coronavirus (COVID-19) pandemic has quickly changed our daily lives, and The Floating Hospital is here to do everything they can for their patients during this public health crisis.

The floating hospital may integrate with portal of patient and hospital availability schedule along National Waterway-1 the patient portal integrates common man and make them easier to avail the benefits of floating hospital.

National Waterway-1 is becoming one of the major attractors for the floating healthcare facility, Varanasi city has better infrastructure, if BHU medical college and Heritage Medical college may associated with Inland Water Transport sector.

Some of the rural places where roads are major challenge, and during health emergency the floating hospital availability become Sanjeevani for their life.

The floating healthcare barge may deploy along the hinterland of Varanasi where trained health educators ensure to set and keep healthy life goals, the floating barges may sailed along the NW-1 and provide workshops and one to one health counselling at wider range.

- Nutrition
- Fitness and exercise
- Life skills training (conflict management, communications, and more)
- Self-esteem and bullying
- Hygiene
- Managing health conditions (asthma, diabetes, etc.)
- Sexual and reproductive health
- Stress management and Self Care.

Floating hospital co-ordinates in spreading of the health education in families in need, including snacks and meals, books to the children and adolescents etc.

²⁹ www.floatinghospital.org, YouTube video, dated 27.04.2021



(Fig No.65. Picture of Boston Harbour, USA, Source: 4 New York, Channel Report, Deployment of 1000 beds floating hospital barge to combat Covid-19 Pandemic)

2.16 IWT Possibilities of Developing Floating Schools, Colleges and University in India: ³⁰

The development of water transportation system is conceptualized as lower cost, environmentally friendly and sustainable modes of transportation for freight handling, however, the transportation sector are not limits with carrying cargo, we have seen various places where Logistics vehicle are integrated part of any commercial or social activities.

Yes, it's true the transports are developed for handling logistics but the applicability and demand of custom-made resources for meeting mass needs with limited available resources.

³⁰ Google Search on 02.05.2021

The most economic problems are scarcity of resources and resources have alternate usages, but IWT may play the role of integrator and facilitates in utilization of resources in best possible ways.

The country like India where most of rural hinterland having mass populations are living along the coastal regions of the river, the development of floating schools, colleges and university along the National Waterway-1 is one of the innovative kind of economic utilization of the resources.

Three big countries have implemented their establishment of floating schools, college and university along the waterways.

Bangladesh is located along the massive delta that created by river Ganges, the Meghna and Bhramputra river, the majority of areas are blown on above sea level of waters, the monsoon seasons has affected most of the civic amenities in these areas hence, Shidhulai Swanirvar Sangstha has established 23 floating schools in their country

The floating schools established barges and use solar panels to provide electricity and power computers. These schools bring the classroom to Bangladeshi children when they cannot get to it themselves. In addition to the school boats, Shidhulai Swanirvar Sangstha operates a flotilla of boats acting as libraries, adult education centres and solar workshops. In 2012, the organization won the U.N. Prize for Inspiring Environmental Action.

The country like Nigeria where lagoon makes region flooded and water logging, the peoples living along the areas of Makoko where during rainy seasons their life gets detreated. The geographical conditions make difficulties for their children to continue their education, hence, The Nigerian architect, Kunlé Adeyemi, in collaboration with the Heinrich Böll Foundation and the United Nations, designed and built Makoko's prototype floating school. The school was three stories, used plastic drums to stay afloat and housed around 100 students.

In northern Colombia, in the town of Sempegua, the rainy season invariably brings flooding and disruption, therefore, the authorities have established first floating schools in Latin America in 2014, the architects of building is designed in such way that could float during the flood seasons.

The school become floating during the flood time and it is always makes operative and functional on ground during rainy seasons, the school house can fit 60 children, and around 400 privileged families will be benefitted from the floating structure.

The school is also associated with part of floating housing solutions that benefitted with construction of small floating houses with inclusive of floating health centre, sports centre, commercial zones etc.

These floating schools provide consistent access to education to children who otherwise would not be able to get to school on a regular basis, but also provide viable infrastructure solutions to places where persistent flooding has been disruptive for decades. Floating schools are just the beginning; the future leaders educated inside these schools are sure to continue developing the full potential of floating infrastructures for their communities.

Let's Integrate these floating school concept along the flooded hinterlands of river Ganga, we always here in news where we have witnessed that Bihar and Eastern Uttar Pradesh is

massively affected with floods prone areas. And the development of floating University, Colleges and Schools may help in integration of utilization of resources in optimal way.

The floating University equipped with all kind of facilities, like library, sports, Gym, classrooms, auditorium halls for lectures and sailed along the NW-1 hinterlands for imparting education in the rural areas of river Ganges. The Inland Waterways Authority of India has established National Inland Navigation Institute along the Bank of river Ganga at Patna, the institute may takes the initiative in developing floating university along the hinterlands of river Ganges.



(Fig. No.66. Bangladeshi Floating School, Imparting School Education with Mobile Resources)

Since 2002, 70,000 children have benefited from Shidhulai Swanirvar Sangstha's 20 solar-powered floating schools. Bangladesh, a nation plagued by incessant monsoons, often has a disrupted school year. During the rainy season, roads become impassable, closing upwards of 4,000 schools for months at a time. Hence floating schools are highly applicable.



(Fig.No.67. Picture of Floating School Developed on IWT Barge)



(Fig No.68. Boat are Deployed for Imparting Education to the Rural Children in Bangladesh)

(Source: Google Search on 02.05.2021)

2.17. Possibilities of Development of Floating Market at Varanasi:

In many parts of the world has already implemented the concept of floating market, where daily needs of goods are sold on smaller boats docked along the banks of river.

In case of Arth Ganga program many floating markets are likely to be developed and that may become the biggest attractor in the country.

Although in country like Bangkok the charm of floating markets are flourishing and local populations visits to those floating market for buying fresh vegetables and daily needs products.

The Varanasi Ghats are very similar where thousands of the public gatherings are happened in evening Ganga Aarti, the establishment of floating market along the Ghats of river Ganga strengthen local economic exchange.



(Fig. No.69. View of Bangkok Khlong Lat Mayom Floating Market for local food and groceries)



(Fig No.70. Amphawa Floating Market Bangkok for Best Local Seafood)



(Fig No.71 Koh Kret Island Floating Market – A Great Place for Hanging Out)

The city like Varanasi has more possibilities of developing floating market because, the all Ghats of the city having public gatherings throughout the year, everyday there is spiritual events like Ganga Aarti performs where thousands of public gatherings happens.

During site visit, personally witnessed that street vending shops are established in evening and morning time at Varanasi city, but where we are developing IWT sector, the recreational hubs may also be developed along the Ghats of Varanasi.

The Arth Ganga Program on IWT sector-initiated efforts for developing community jetty along the Ghats of river bank, hence, establishing the places of floating markets along the NW-1 hinterlands by identified the economic places, helps to the local economy along the hinterland of river Ganges at Varanasi city.

In India the vibrant floating market example is Dal Lake floating market, Srinagar, the one need not to wonder place to place for buying anything, floating market reaches to shore side of heavenly mountain city and addups charms of Vegetable floating Market.

Similarly, Varanasi city has already various things can be added up in floating market like. Souvenir shops, vegetable floating market, milk floating market, fisheries floating market, flowers floating market and local goods and groceries floating market etc.

The Ganga Ghats are vibrant at Varanasi and centre for place of attraction for tourist, nationals and local public, the Ghats and nearby areas having many spiritual events are performed, therefore, this place is very ideal for developing floating market economy.

The local businessman living along the hinterland of river Ganges may visit to the floating market by carrying their local produce through using community jetty developed under Arth Ganga program and visit near to the Ghats of Varanasi and establish floating market of all type where local public enjoys shopping at river front. ³¹

2.18 IWT based economic development prospects at Varanasi:



(Fig No.72. IWT based economic development prospects at Varanasi)

³¹ National Inland Waterways in India, Strategic Report, Shripad Dharmadhikary JindaSandbhor, Published by Manthan Adhyayan Kendra and SRUTI 30 March 2017

Chapter 3

Research Methodology

3.1 Background of Research:

The Development of National Waterway-1 is expected to be overhaul through Jal Marg Vikas Project and augment exiting infrastructure along the waterway's routes from Varanasi to Haldia.

Varanasi being cluster located on major focal plane of freight corridor vide development of EDFC and Golden Quadrilateral roads, therefore, the development of multimodal logistics park and IWT port on river Ganga facilitates in overall regional logistics transshipments.

The development of National Waterway-1 at Varanasi boosts various economic development in the region, the research envisaged and apprise long – medium –short run economic benefits assessment by development of Inland Water Transport sector at Varanasi region.

The development of water transport for passenger and cargo services provides quantifiable tangible and intangible economic benefits to the populations living along the Varanasi region. The IWT sector development has seek support of various stakeholder in its development and the research has asses' perceptions of multiple types of stakeholders while making formal assessments.

The stakeholders are mapped according to their clusters, expected benefits from the project and opportunity envisaged with development of economical modes of water transport facility for passenger and cargo transportation services.

3.2 Approach used for conducting research study:

A scientific and systematic research methodology was adopted to address the stated objective of the research problem, as the study was spread out entire Varanasi region with assessment of existing transport and developing conclusive economic benefit of IWT sector in Varanasi region.

The theoretical framework has been envisaged and adopting to fix the research strategy and linear the process of study, in primary process the different framework has been established for identification of prospective IWT stakeholders, once the stakeholders are mapped, thereafter, their perception are planned to be evaluated regarding development of Inland Water Transport facility at Varanasi region.

The scoped using statistical and research tools are used to gauge market and economic potential of water transport sector at Varanasi region and penetrate the research strategy to source and gauge the market perceptions and potential regarding economic development association with Water Transport facility.

Following approaches were used for the research studies:

- a) Descriptive research method was used to make enquiries regarding economic development prospects vide development of Networks of Inland Water Transport in the Varanasi region, where data was collected vide survey methods and research established economic development comparative and co-relations with IWT sector development in the region.
- b) Analytical approach was applied to analyse the facts and information's available on IWT sector and made the critical economic application and impact evaluations of development water transport facility in the region.
- c) Qualitative & Quantitative each approach was applied in terms of finding traffic potential of the region and their diversion applicability on Waterways and also applied to every factors in the research study
- d) Conceptual and Empirical research methods are also applied to verify the facts of IWT sector and economic impacts, the variables are stimulated with facts and proved

through development of context studies and analysis of survey data and available secondary information's.

3.3 Development of Research Framework:

The fundamental task is to find the O-D pairs along NW-1, cargo type that used to transport with IWT barges along NW-1 from Varanasi and Vice –Versa, and find other trades associated with IWT Transport and establish economic linkages with it.

The field study identifies prospective stakeholder to be associated with IWT sector, a numerous round of due diligence and review of literature has been done on the subject to pilot the probable list of common stakeholders for IWT sector at Varanasi.

The methodology used for study to cover the approach of finding possible elements of economic investments made through IWT sector by Government at Varanasi and secondly understanding the business environment and current market demand of logistics sector at Varanasi and public interviews will be conducted along the all 84 Ghats of the Varanasi in order to access their requirements and identify the economic centres which can be associated with water-based transportations.

- Peer review of existing journal and studies related to inland water transport sector available at Ministry of Ports, Shipping and Waterways.
- Overview of available variables of transportation economics followed presently in the country and internationally.
- Case study and in-depth interview methodology will help significantly to execute this research study.
- Use of qualitative and quantitative data sets for expediting research works.
- Collection of primary data by doing Sample Survey of existing Industries located in the Varanasi region and understanding about their production capacity and future expansion plans with help of questionnaire and in-depth Interviews.
- Using of secondary source data relating to their economic aspect of transportation, government regulatory policies regarding IWT transportation and consultation with Industries and stakeholders to know their opinions for using IWT sector at Varanasi etc.
- Studying the geographical aspects and District Industrial profile of Varanasi and nearby regions.
- IT & Statistical tools to be used for analysis and data comparisons to draw the inferences.
- Publications of research paper and paper presentations in the conferences/seminars etc.
- Evaluation, analysis of data set and preparations of research report etc.
- Primary survey for knowing the present traffic conditions of Varanasi and taking random opinion of minimum 500 samples from public interviews, FGD, Observations, Questionnaire, Trucker survey has been conducted.
- Counting of number of trucks passes on the NH-2 with selected interval hours to draw the inference roadways traffic and subsequently interviews with truck drivers at Dhabas and local transporters will help to understand about the cargo flows pattern in the region.
- Using secondary data from Ministry of Railways and World Bank reports to analyse the traffic volumes of past and future projects.

- Assessment of tourism scopes and ferry services opportunities for region by doing proper 84 Ghats survey and collecting data from general public interviews and feedbacks.
- Using the data of Central Statistical Organization like Consumer Price Index, Annual Survey of Industries, State Gross Domestic Production for drawing the result of change expected in growth due to development of upcoming facility on National Waterways – 1 at Ramnagar Varanasi MMT
- Utilizing the statistics of Transport Department regarding number of vehicle registrations, types of vehicles registered, rising and growing demand of freight transportation, traffic data etc.
- Secondary data from local municipal bodies will be utilised to understand the applicability of IWT mode for urban transportation's needs.
- O-D Survey and Interactions with business owners, warehouses, ICDs and other stakeholders.

The identified stakeholders are largely clubbed into three typologies to ease the understanding and analyse the Water Transport economic benefits for Varanasi Region.

- (a) Industries and Business Cluster/Traders of Varanasi region
- (b) Government and Non-Government Institutions
- (c) Community living along the river hinterlands

3.4 Development of Hypothesis

Inland waterways are the emerging economic sector at Varanasi region for attracting business investments opportunities, the research findings may extend benefit to the policy makers, government departments, financial institutions, entrepreneurs, industries, transporters, shippers and business organization for optimising their economic activity and may associated them for adopting new age river-based transportation for gaining economic advantage.

Research is concentrated to identify the economic importance associated with the usage of Inland Water Transportation at Varanasi, which affect deeply to the economy by shifting of freight loads form roadways to railways to waterways thus it encourages the culture of multi modal and intermodal transshipment of cargo and upcoming more numbers of Inland waterways transport will definitely affect the economies cost efficiency in the development of the region.

Model shift of cargos transportation to IWT mode, this will increase the numbers of international projects which may create the base for development of major projects in Varanasi Region.

IWT development gives encouragement to the private sector participations and more over with financing requirement, the stakeholders will refer to the research study for formulation of business strategy to get economic profit by reducing their total logistics costs.

Moreover, the economic benefits of waterways transportation will be identified by the researcher and promotes the opportunity of economic investments under major projects, sub projects for business development and growth due to National Waterways - 1 in the Varanasi region

IWT sector is the competitive alternative mode of transportation compared to rail and road transport, offering an economical and environmentally friendly mode of transport in terms of energy consumption efficiency, noise and greenhouse gases emission and emission other environmental pollutants.

River Ganga is the most suitable for navigation of Inland vessel where sufficient water depth available and development of terminal facilities along the bank of river Ganga near major identified cities in the hinterland of NW-1 will boost the economic activity of the region.

Coal, cement, construction material, bulk goods, break bulk goods, oversize cargo, project cargo and ODC cargo etc. were the major attractor goods for transportation through IWT and the major hinterland of NW-1 has the availability of these cargos.

For Industrial development it is necessary to provide the specific infrastructure support through investment in Inland Water Transport sector and the location specific IWT support offers and influence in the economic growths of region.

Inland Water Transport sector connects rural locations to urban markets and IWT influence economic activity in the region, where logistics support will led to the development of various agro-based industries along the banks of river ganga to utilise water transport facility to access the markets, the rural population engaged in agriculture and lives near the bank of river Ganga IWT will offers seamless connectivity to them for direct economic participation by selling of the produce on best market price.

The development of suitable and reliable IWT system will be beneficial for the Varanasi region and to all resident living along the hinterlands or riverbank of Ganga

Following hypothesis are being developed and expected for getting desired research output:

- Research helps for marketing intelligence and provide the recommendations for various investment opportunities associated with Inland waterways transportation sector at Varanasi
- It provides multiple options to the stakeholders and associate them with IWT infrastructure for their economic growth.
- Research report will be utilised by the policy makers, government authority, stakeholders, logistics and shipping companies other related agencies whomsoever involved in cargo transportation and supply chain management solutions business.
- Study helps to creates sound understanding about the regional industrial profile and highlight the various types of trades and business taken place at Varanasi.
- The reported information's can be used for taking business and commercial decisions and stakeholders will be get benefitted.
- Identification of key industrial clusters and their cargos which required the smart logistics solutions for facilitating business transactions.
- Analysis report on existing logistics facilities at Varanasi and bottlenecks in their present services. Research will identify economic competitiveness of IWT sector over other modes of transport.
- The pertinent research information will be quoted for economic investment decisions by the stakeholders.
- Identification of various employment opportunities are generated through execution of IWT projects and promoting the various allied economic activities.

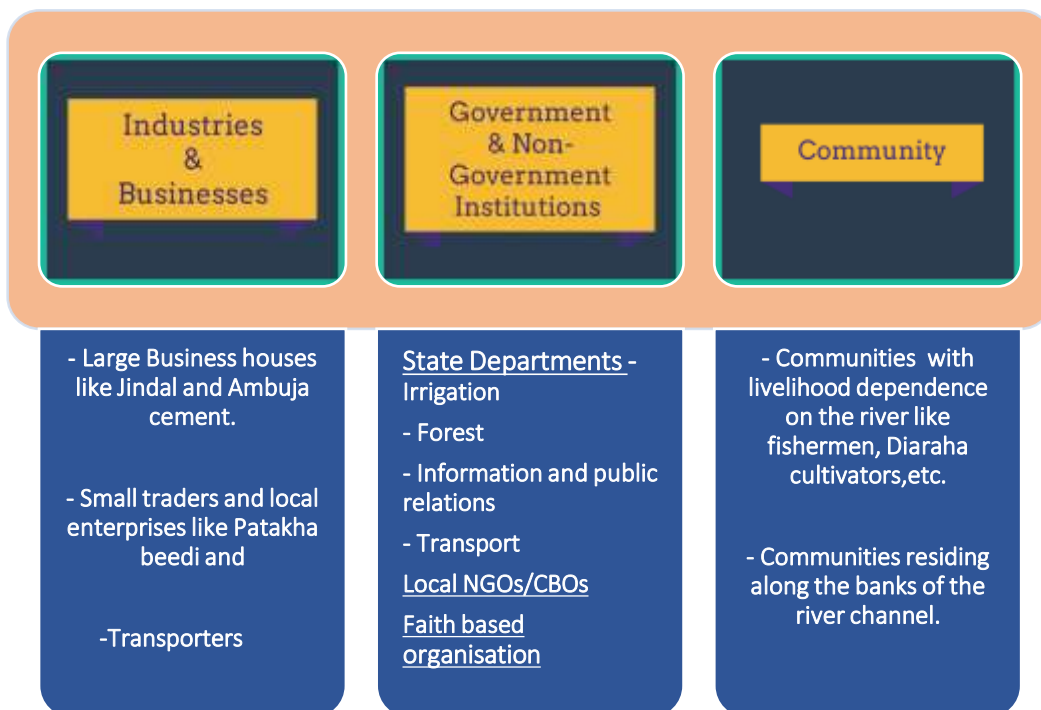
- Research will address the needs of logistics thrust of the region and provide the suitable information on viable O-D pairs and commodity mix which can be transported through IWT sector.

3.4.1 The research will address the following problems:

1. To examine the economic development opportunity associated with Inland Waterways Transportation and how local and regional stakeholders get benefited.
2. Measure the linkages of IWT base with regional Investment base and creation of more business development options at Varanasi.
3. Identifying the importance of Inland ports for the region and addressing economic impact on total logistics costs for trade and commerce.
4. Measuring the economic efficiency of riverine port, how it can be utilized by the regional stakeholders and assessment of the diversion of cargo traffic flows through riverine port that leads to creation of new economic opportunity.
5. Accessing the suitable freight movement pattern for regional transportation and finding strategic connecting linkages with IWT sector and supporting existing Industries of Varanasi for making their identical logistics plans to achieve competitiveness.
6. Research will address to the question that how Inland Waterways Transportation sector (IWT) will socially affiliate to the communities living along the hinterland or river banks of Ganga and finding suitable methods to promoting the IWT sector for their usages.
7. Analysing overall IWT contribution for solving the problem of passenger transportation, urban transportation and smart logistics management through National Waterways.
8. Understanding IWT sector efficiency and maritime transportation economics and how it can be leveraged through riverine based multimodal transportation.
9. Measurement of socio-economic benefits laying along with development of Inland water transportation sector in the Varanasi region.
10. What is the commodity/cargo/freight will be available before IWT sector transportations through Inland barges and findings out the Inbound and out bound cargo available in the region for modal shift on National Waterway – 1
11. Addressing IWT comparative cost with surface mode of transport and concluding with economic benefit analysis and opportunity cost by reducing total logistics cost of existing shipper.
12. Finding out the perception of stakeholders and helping them in planning of their logistics management of existing freight flows and facilitating to utilise IWT infrastructure for transportation purposes.
13. How IWT sector will gain advantage over other modes of transportation Vis a Vis. Railways, Roadways and Airways etc.
14. Characterising the economic behaviour and business potential of river fronting areas at Varanasi and identifying the various development options of Varanasi Ghats for business purposes.

3.5 Process of Mapping IWT Stakeholders: ¹

The detailed stakeholder mapping is being conducted during research and mine out the expected benefits from research studies.



(Fig No. 73. Mapping of IWT Stakeholders, Source: IWAI, Communications need assessment study, conducted by M/s AMS)

Industries and Business: One of the key groups of stakeholders expected to benefit from this project are the industrial/businesses and manufacturing units. This project avails an opportunity for economical transport of bulk material along the proposed route at Varanasi region

Government and Non-Government Institutions:

Relevant State Government agencies were identified as stakeholders in the project to gauge and convey the existing perception about the project for internal deliberation processes. Upon Interaction with the IWAI representative's unanimous selection of selective State Departments were identified based on their prospective involvement for further state level consultation with regard to the project.

The state level Government departments identified for the project are listed below:

- (i) State Irrigation Department
- (ii) State Forest Department
- (iii) State Information and Public Relations Department
- (iv) State Transport Department

¹ IWAI, Communications need assessment study, conducted by M/s AMS

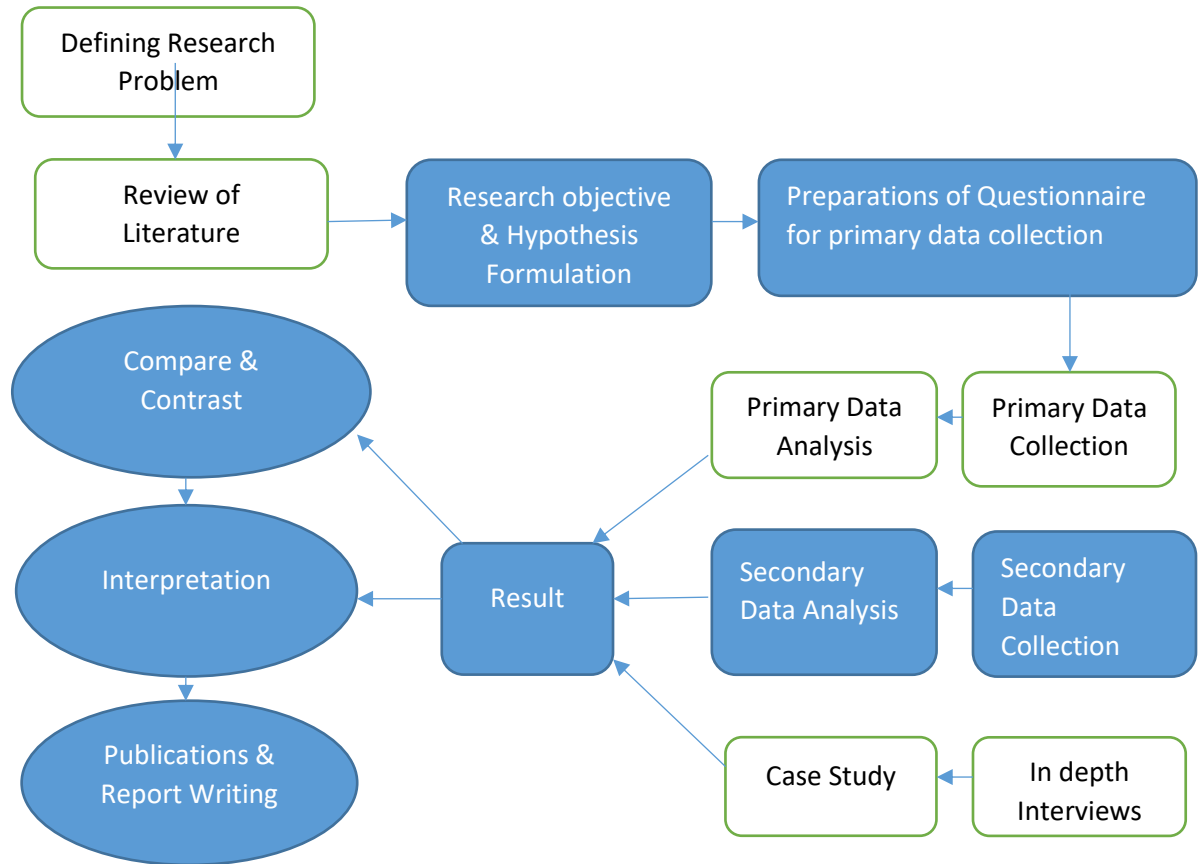
Community: Identification of existing perceptions and addressing the same about Water Transport Development Project at the background of all the processes involved in devising an effective economic strategy for the project development.

As the economic needs assessment attempts to gauge perceptions and secure the confidence of the communities directly or indirectly influenced by the water Transport Project, it becomes critical to identify different stakeholders within the communities along the river in the identified clusters.

The rationale behind identification of the communities is based upon the perceived impact of various interventions and sustained impacts from the project, a brief list of expected stakeholders at the community level to be discussed in detail in specific clusters have been listed below:

- (i) Fishermen,
- (ii) Boatmen,
- (iii) Farmers/Cultivators
- (iv) Elected representatives within the village/ward.
- (v) Households residing along the banks of river Ganga.

3.6 Research Design and Flow Chart:



(Fig No. 74. Flow Diagram of research design)

3.7 Research Methodology:



(Fig.No. 75. Flow Path of Research Methodology)

3.8 Sampling Approach:

The study requires data collection at two different levels, depending upon the type specificity of the stakeholder being addressed. The stakeholder's identified have been clubbed into three categories based on the type of tool adopted for data collection in an attempt to provide a homogenous sample group throughout all the clusters. However, it must be noted that the number of focus group discussions and mini group discussions varied throughout the clusters depending upon the availability of a stakeholder target group in each cluster

The following sampling methods are used widely in research for sample selection:

- a) Deliberate sampling methods are used, the participants selected based upon their availability and convenience
- b) Judgemental Sampling, the response was collected by judging the prospective and real users of IWT in the represented populations available at the Ghats of Varanasi
- c) For selecting the Industrial Units survey the simple random sampling methods is used to select the units for conducting the research
- d) For conducting traffic study and truckers survey the systematic sampling was done to find out the traffic loads of the city
- e) Cluster & Area sampling methods are also used for conducting the perception study and socio-economic studies etc.
- f) Unrestricted sampling designs are also applied wherever required

3.8.1 Sampling Methodology:

The sample frame was fixed based on geographic catchment area where National Waterways- impacts economic development at Varanasi city, the survey was conducted with 350 stakeholders for each type in clusters identified in the objective. As proposed, a sufficient representation of the numbers of was ensured on both sides of the river bank in each cluster in order to gauge the perception and understanding stakeholders residing on both the right and left banks of the river. Villages/wards were selected cluster wise for the purpose of stakeholder's perception survey. Two key principles were adopted in selection of the villages/wards

(a) The proximity of the village/Ward from the river (preference to villages/wards situated on the banks of the river)

(b) A fair distance between the two sampled villages/wards

The randomly selected stakeholders were chosen for survey in each of the selected village/ward. Thus, a total of 450 different types of stakeholders was covered during study.

Other identified stakeholders were sampled based on their presence and availability in the specified clusters. The stakeholders identified at the government level were consistent throughout all the states and a consistent sample size was chalked for them. Whereas, the coverage of other stakeholders like business/traders/transporters/NGOs/Faith based organisations was subject to their presence in accordance with the intended intervention in specific clusters.

Following were the details of the stakeholder's interactions and preliminary survey were conducted at Varanasi for setting of research plans

Sr. No.	Population Type Selected for Preliminary Survey:	No. of Samples taken
1.	Cargo Owners	50
2.	Freight Forwarders	50
3	Transporters	50
4	Truck Surveys on National Highway	150
5.	Local Public, Tourist, Fisherman, Boatman and regional stakeholders	150
Total		450

(Table: No.9 Details of Sample Survey)

3.8.2 Techniques adopted for collecting data:

As this study adopts a mixed-method approach towards data collection both qualitative and quantitative information needs to be gathered from the field in order to address the specified objectives. Thus, a list of identified stakeholders with the respective methods/tools adopted for data collection has been represented in the table given below:

S.No.	Category	Stakeholder	Tools for data collection
1	State Government	Irrigation Department	In-Depth Interviews (IDIs)
		Forest Department	
		Information and Public Relations Department	
		Transport Department	
2	District level officials	DPRO/DICO	In-Depth Interviews (IDIs)
3	Block level Officials	BDO	
4	Cluster level	Faith based organisation	Focus group discussions (FGDs)
		NGOs	In-Depth Interviews (IDIs) & Questionnaire
5	Industries/Businesses	Truckers Survey	Focus group Discussions (FGDs) & Questionnaire

6	Community	Transporters/Cargo Owners/freight Forwarders	Mini Group Discussions (MGDs)
		Tourist	In-Depth Interview & Questionnaire
		Fishermen/Boatmen/Cultivators/etc.	Focus group Discussions (FGDs) & Questionnaire
		Local Public survey	Open and closed ended Questionnaire

(Table No.10. Listing of holistic approach adopted for data collections)

3.8.3 Primary data collections:

To assess the perception the primary survey was conducted to identify actual research problems and this activity was helpful in setting up of the research objectives.

The literature reviews have given lots of understanding and information's about the research subject but assessment of real objective is only possible by doing preliminary survey at Varanasi city.

The survey has been conducted in form of personnel interview, observations methods, focus group discussions and short questionnaires are used. .

The understanding of the stakeholders has been clubbed into three broad categories in an approach similar to that adopted for stakeholders in the previous section. The three broad categories of perceptions assessed has been provided below:

(a) Vision: Perceptions under this category largely include the extent of understanding of the stakeholder about the interventions that are being brought in through this project and the probable future outcomes from the same.

(b) Technical: This category largely encompasses the perceptions on the technical aspects of the project with regard to its feasibility for navigation on the proposed route, the existing navigational challenges, etc.

(c) Social: This category of perception largely comprises the probable impact the project might have on the community and other stakeholders with regard to the existing culture, livelihood practices and dependence, and relief and rehabilitation wherever applicable.

Primary data collection technique has been describing above, however some other techniques are also used in the research

- a) By Observations
- b) Through Personnel Interviews
- c) Through Telephonic Interviews etc.

d) Through Questionnaire

The in-depth interview was designed to discover underlying facts on IWT Impacts, choose the situations which are applicable and relevant to this research, the interview was held to explore need, desire and perception of respondents for using IWT multimodal transport for passenger and freight carriage, the projective and non-projective interview techniques were applied in finding facts and figures with in-depth interview research.

Appropriate methods used for data collections:

The research required many types of efforts therefore judiciously methods are selected for conducting the study:

- a) Strategy of data collections are prepared based upon the nature, scope and objective of the research
- b) Availability of the funds were mapped and data collection and research plans made
- c) Time considerations are taken into the account and prepared appropriate plans and accordingly acted.
- d) Setting of precisions for the research, yet another important factors to be considered before stepping any activity in course of data collections and conducting of research.

3.8.4 Secondary Data Collections

In secondary research the content analysis of documentary materials such as news, books, magazines and all other verbal and video content materials concerning to the characteristics of research are identified and considered, the review and analysis of the facts have been developed based upon the facts of upward and downward traffic movement along National Waterways-1

The most qualitative approaches are used in analysis of documentary facts and review the area of research and insantity of forces applicable.

In summary, secondary data were collected from the following:

- a) Feasibility report
- b) Master plan studies
- c) Cargo studies
- d) India-2005
- e) Websites
- f) Literature and documents
- g) Passenger movement details
- h) Cargo movement details
- i) Hydrological data

The secondary data possess the following characteristics are applied in the research

- a) Facts of secondary research having reliability of data
- b) Data facts was considered that having suitability of data in drawing inference for the study
- c) The enquiry was made to identify the level of adequacy, the facts of data was checked and considered for the research when it was adequate and reliable for the research studies.

3.8.5 Case Study Methods:

Another qualitative analysis adopted in careful and complete observations of the social units, to conclude the research activities the case study methods was interrelated with primary, secondary findings, the parameters of the research was fully analysed and emphasis was given fulling on the points where research objectives have been fixed earlier.

The Socio-economic situations of Varanasi was co-related with case to case-based studies in terms of utilising Inland Water Transport modes effectively. The situations hypothesised and prepare cases of considering facts of Inland Water Transport sector at Varanasi and based upon finding availability the qualitative analysis was carefully prepared for individual and community level observations etc.

The proposed research on Inland Water Transport is socio-economic impact in nature, stakeholders' perception are linked with its economic utilizations therefore for clearing the facts and configuring the circumstances of IWT sector economic impacts in favour different possible situations are developed in form of case studies and research were carried further to illustrate the facts and support research findings

Transportation sector are thired variables in business units, Logistics costs, transport performance, inventory cost and time factors are indirectly associated, therefore each business units selects and develops own logistics model based upon their needs and requirements, hence considering case study approach enables in understating the facts for economic applicability of transport sector.

Case methods approach supported in understanding randomly selected business unit for study, where the present logistics supply chain was reviewed, evaluated and considered facts and cost centre associated with logistics based upon suitability and applicability in business models. Hence development of case-based approach is highly applicable in transport research to showcase the most efficitinat applicability of Inland Water Transport sector to present as modelled for business units operating with similar nature of business sets.

3.9 Statistical Methods used for Data Analysis:

Post primary data collections and accumulating secondary data, it was processed and analysed in accordance to the objected outlined for the research study, The IWT based transport research required systematic and scientific analysis to draw the inferences.

The hypothesis was statistically tested and opined the general ways to co-related the data and situations to find the research answers, decision rules are applied to test hypothesis and also checked type 1 and type 2 errors, the following operations were adopted for processing concepts of research

- a) Editing of data: the data collected was edited based upon finding errors or omissions and corrected in matter of facts
- b) Carefully scrutiny of the questionnaire and uniformly organised all possible data and facilitated with tabulation in appropriate way to analyse and interprets the results.
- c) Multivariate analysis and inferential analysis were done in order to determine the validity of data and indicate conclusions
- d) Means of Central Tendency was also used in the research study

- e) Time Series Analysis were applied in order fix the context of economic research, the data relating to some time periods was factored to get the research results.
- f) Estimation Methods are also applied to investigate about the cost of current logistics and possible logistics with IWT mode, the approach was applied based upon the requirement in this research.
- g) The Alternative approaches are used for calculating the cost of transports and statistically applied for suggesting applicable modes for particular identified sets of business units.
- h) Maximum likelihood method analysis made for factor loading successively in such a way that maximum possible populations co-relation matric can be prepared for users of Inland Water Transport sector.
- i) Cluster Analysis methods was also applied to classify impact developing Inland Water Transport sector at Varanasi, the variables are co-related where basic objective of clusters possible stakeholders are determined, through this technique the segmentation is done foe socio-economic consideration, psychological factors, perception study and other social factors are involved in the development of Inland Water Transport sector at Varanasi.
- j) Multidimensional Scaling techniques is also applied to identify best suited Origin and Destination pairs for the stakeholders, and multidimensional scaling on transport variable are applied to determine specific decisions.
- k) Path Analysis methods are highly used in research, the various socio-economic activity variables indicated and attached to the Path Analysis approach, where various linier assumptions are co-related to established the desired path to be followed by the prospective users of Inland Water Transport.

3.10 Use of ICT in research:

The computer and Internet sources are highly used during research since inception to implementation of research, the role of use of advance level of computing are needed while conducting study. The data analysis, interpretation and report writing where the computers are highly helpful.

For data analysis, the various research application software are used, multiple techniques like average, percentage and correlation etc. are applied. The most frequently software packages used i.e Excel, Word, Power Point and Statistical software etc. was used for data and variable analysis, the SPSS and Statista (online Statistics Software Version) are statistical software applied for drawing statistical inferences in the research

These above software packages are used for checking reliability of data, establishing and testing hypothesis etc. the computers are used during entire research process.

The computers and software packages are supported while checking of errors, accuracy and authenticity of data, establishing and testing hypothesis etc.

The ICT are applied in drafting of research tables and interpreting the research easily. These table provide clear and sound footprint of interpretation of researcher.

The computer technology supported in converting research finding into the research article and report that was published for part of Ph.D requirement

After completing the research studies, the computer has helped in safeguarding all types of data on computer and the referencing style are followed while listing research references.

3.11 SWOT Analysis:

The cluster an overview of existing strengths, weaknesses, opportunities and threats are summarised and areas for immediate attention and action will is identified as well. The SWOT analysis helps in creating a “IWT economic strategy” to address threats identified. It must however to be noted that Strengths and Weaknesses here are identified as internal factors while opportunities and threats are factors external to the project and largely comprise findings from the Transport field.

3.12 Research Steps Followed:

STEP – I
<ul style="list-style-type: none">• Setting up the research problems in context to the IWT sector• Review of the available literature and formulating hypothesis related to the economic benefits and development opportunities associated with IWT sectors• Finding the linkages of waterways transportations with the other economic activates of the Varanasi region• Hypothesis formulation for various scenarios of IWT Mode.• Preparing questionnaire for collecting the primary data• Formulating Sample Frame and Targeting the sample sections

STEP - II
<ul style="list-style-type: none">• Collecting the primary data through questionnaire, In-depth Interviews and field observations etc.• Collection of the secondary data from transport authority, private agencies, published journals and using statistics of transport sectors.• Estimating the railways, roadways and waterways transportation demand• Multivariable regression analysis will be used to analyse for each vehicles category to determine the future logistics demand of the region• Estimate the tourist travel volume of the region based on the past data• Assessment of independent variable like SGDP of transportation sector and analyse up to the district levels• Understanding the present industrial profile of the Varanasi and their future capacity expansion plans and storage demands etc.

STEP III

- Assessment of O-D pairs for different types of cargos with help of interview techniques with truckers, freight forwarders, warehouses, ICDs and Transporters of Varanasi
- Socio - economic assessment for understanding the effect on IWT sectors on the existing fisherman and local boat operators at Varanasi
- Study of transits and establishment of transport networks of IWT sectors with other modes of transportation
- Estimating the energy demand and fuel efficiency and environmental benefits of IWT sector
- Multivariate analysis for Transportation, Fuel consumption, demand and environmental protection with IWT mode
- Analysis of freight and passenger flows and usages of case study methods, reference of transportation economics, management science and statistics for conducting the research
- Cost Analysis, Impact Analysis and Economic Analysis will be done
- Conference and Research Paper Publication in the National and International repute Journals
- Report Writing and Thesis Submission

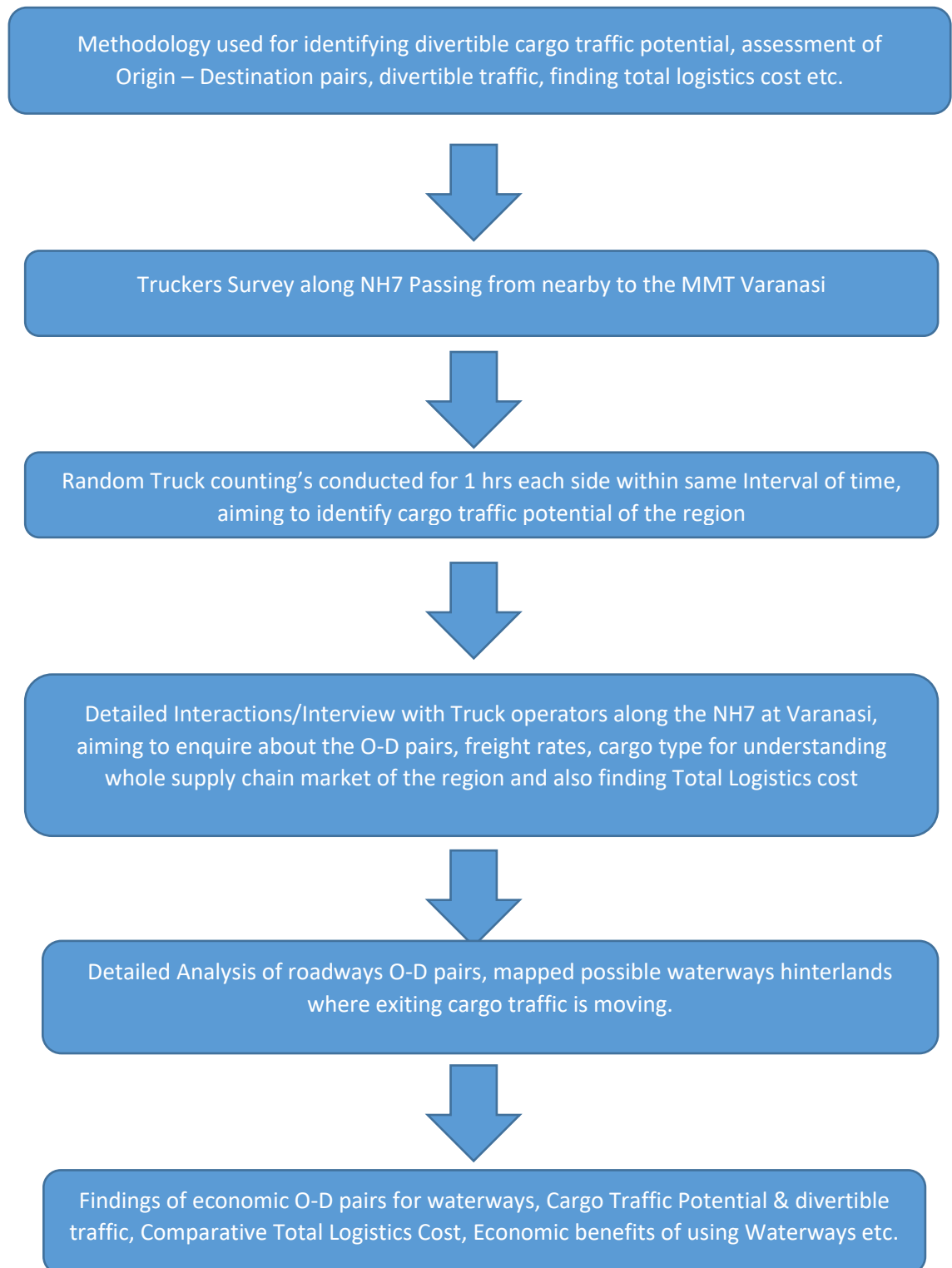
(Table No. 11, Planed stages of research steps)

3.13 Identification of Research Problem



(Fig No. 76)

3.14 Method developed for identifying Economic O-D pairs, Cargo Potential, Logistics Cost Assessments etc.



(Fig No. 77 Methods of Identifying O-D Pairs)

3.15 Research plan followed:

Following tentative work plan is being proposed with tentative completion timelines of research work within time frame are as follows:

<i>Work Identified</i>	<i>Tentative completion Timelines</i>
Peer review of journals, literatures and case study	8 weeks and to be continued
Formulation of problems and research design and attending National/International Conference / workshops etc.	6 weeks and to be continued
Preparations of questionnaire and depth-interview format	6 weeks
Sample survey and collections of primary sources of data through questionnaires & In-depth Interviews with Local Community, Industrialist, Traders, Business associations, freight transporters, Shippers, Warehouses and cargo owners etc.	12 weeks
Tabulation and analysis of primary data and attending National/International Conference / workshops etc.	6 weeks
Writing of 1 st research paper and publication as per UGC guidelines	7 weeks
Sourcing for secondary source data from various government department and agencies related to the IWT and analysis of data.	10 weeks
Publication of 2 nd research paper and conference presentations as per UGC guidelines	8 weeks
Data analysis & report writing	14 Weeks
Internal evaluation of Ph.D thesis before final submission	15 weeks Anticipated
Correction measures & final Submission of Ph.D thesis	10 weeks Anticipated
P.hd viva – voice & evaluation	10 Weeks Anticipated

(Table No. 12: Research Plan)

3.16 Research Outcome:

Inland waterways are the emerging sector for economic investments opportunities, scholarly research will benefit to the policy makers, government, financial institutions, entrepreneurs, industries, transporters, shippers and business associations in optimising the economic benefits associated with river-based transportation on Ganga.

Following was expected output and importance of the research listed below:

- Research helps for marketing intelligence and provide the recommendations for various investment opportunities associated with Inland waterways transportation sector at Varanasi
- It provides multiple options to the stakeholders and associate them with IWT infrastructure for their economic growth.
- Research report will be utilised by the policy makers, government authority, stakeholders, logistics and shipping companies other related agencies whomsoever involved in cargo transportation and supply chain management solutions business.
- Study helps to creates sound understanding about the regional industrial profile and highlight the various types of trades and business taken place at Varanasi.
- The reported information's can be used for taking business and commercial decisions and stakeholders will be get benefitted.
- Identification of key industrial clusters and their cargos which required the smart logistics solutions for facilitating business transactions.
- Analysis report on existing logistics facilities at Varanasi and bottlenecks in their present services. Research will identify economic competitiveness of IWT sector over other modes of transport.
- The pertinent research information will be quoted for economic investment decisions by the stakeholders.
- Identification of various employment opportunities are generated through execution of IWT projects and promoting the various allied economic activities.
- Research will address the needs of logistics thrust of the region and provide the suitable information on viable O-D pairs and commodity mix which can be transported through IWT sector.

3.17 Structure of Research Report:

Chapter 1	Gives a brief background the project, objective, scope and methodology of the study
Chapter 2	Highlights the IWT Transport profile & Literature Reviews
Chapter-3	Description of research methodology, deals with the data collection and analysis tools description
Chapter-4	Discusses concepts and research findings etc.
Chapter-5	Discusses research consultations carried out for IWT sector and distinguish economic role of IWT sector
Chapter-6	Summarising research findings includes best suitable research recommendations etc.

(Table No. 13: Structure of report)

It can be seen from the research report that there is immense potential for development of inland water transport in the Varanasi Region, if the work of development of river routes is taken up with a long-term perspective and in a systematic manner by both the central and state governments. The problems of the existing users should be properly addressed in order to find realistic transport solutions. The economic Incentives and other financial assistance need to be extended to users and operators. Modern technology should be adopted in the execution of IWT sector development works and the modernization of vessels, both in the organized and unorganized sectors get benefitted by Water Transport facility.

Chapter 4

Research Findings:

4. Research Findings

The industry of transportation and logistics has played vital role in the enlargement of trade and commerce in the nation, enhanced efficiency of logistics handling ability with development of logistics infrastructure that matters for expansion of domestic and international trades, In the liberalized economy has magnitude trades world wide-reaching with amplified volume day by day, therefore the need of logistics sector development for trade apprehends as inter-dependable variables for strengthening the economy of the nation.

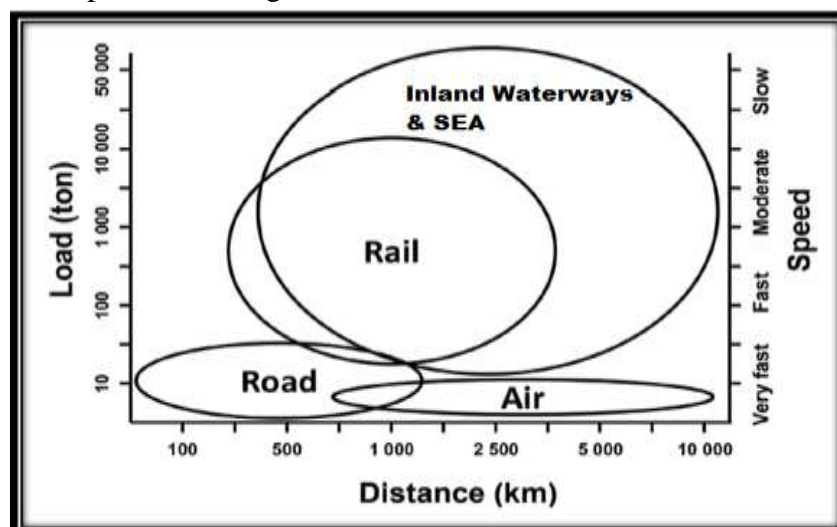
In empirical research investigations findings states that logistics industry directly impacts on trade framework and equations of logistics performances may facilitates trade and economic growth of the regions, whereas the efficiency of enhancing logistics infrastructures may offers relative complimentary benefits in strengthening the economy at producer/manufactures level, it also ensures for transportation of goods within cost effective margin and minimum possible time lags.

The logistics and transportation are supporting arterial activities of trade and commerce, it offers numerous of socio-economic benefit by contributing in rise of the income and savings that helps for achieving economic objectives of any nation.

The empirical studies reviled facts that overall improved logistics services are crucial for the development of domestic and international trades, hence the transportation, logistics and warehousing forces will drive economic units in greater trade participations and may reap out the benefits of achieving global trades in much better way.

The transportation planning may lead to gain edge for the management of supply chain by merging various transportation nodes and linkages that ensures for reduction in total logistics cost, primarily in the selection of right transportation modes largely pivot around the constraints of load, distances and speed. Thereafter the logistics cost are evaluated in development of freight logistics strategies

It is more important to understand the interrelated relationships of various transportation modes, the relationship of load quantity, speed of transport and how far the cargo to be transported, these parameters were considered while preparing suitable logistics plan for handing freight. Understanding of the relationships is important for taking decisions for intermodal transhipments of freights are the terminals.



{Fig No.78. Relationship of Transport modes with Load, Distance and Speed,
Source: WIT Transactions on State of the Art in Science and Engineering,

¹The Railways and Roadways modes of transport allows overlapping in suitability of handling relatively smaller loads of cargo over short and moderate distances, and the similar transshipments possibilities were merged with Rail and Road with Sea/Inland Water Transport, the intersections of these Road, Rail and Marine transport reinforced the transportation efficiency and reduce the total logistics cost.

Whereas the Air transport is known for fastest modes of transport therefore the lower weight loads is preferred for transportation to the longer distances by this mode of transport. Hence the integration of air transport with any other mode of transport is different. Only roadways modes with dedicated trucks services were used for providing feeder services to enable the shipment delivery to the end point.

But the relationship of integration with Road, Rail, Inland Waterways and Sea is very high, the road and rail have the characteristics that allows shipper to select and inter use the transport modes as per their requirements and availability, hence the choice overlaps are flexible in between them, whereas the Inland Waterways and Sea modes of transport carried larger volume of cargo as compared to the Railways or Roadways for longer distance, therefore the load transshipments were done at ports through road and railways.

The integration of various modes of transportation services leads to develop the logistics hub where the probability of development of value added industries are possible to strengthen packaging, warehousing and distributions etc.

Development of Inland river port at Varanasi similarly emerges regional economic facility where MSME industries flourishes, there was probability of setting up of various industrial hubs and large scale logistics transshipments were possible here, therefore Government has planned to establish Freight Village Industrial cum Logistics park near to the multimodal terminal Varanasi.

The Inland Water Transport facility at Varanasi region opens the doors of global market trades by providing seamless Waterways connectivity with sea through the route of National Waterway 1 (Ganga- Bhagirathi-Hooghly) river system.

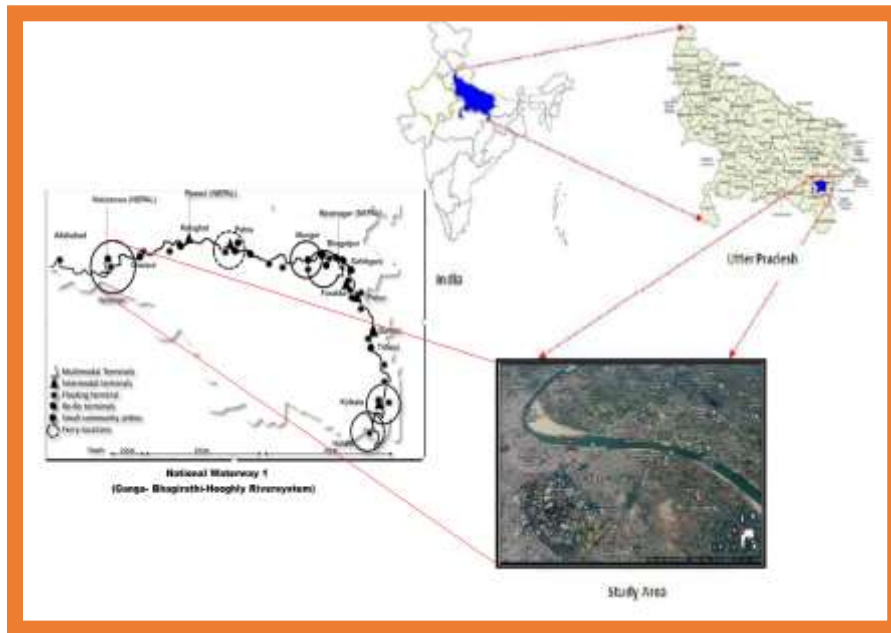
The IWT multimodal terminal was build up in Varanasi region on river Ganga the project was up taken through the help of World Bank technical and financial assistance and it was implemented under the SAGARMALA programme of Jal Marg Vikas Project for capacity augmentation of river ganga to use for transportation and logistics purposes.

From Varanasi multimodal IWT port it is proposed that 1500 DWT to 2000 DWT of barges were played in different seasons depending upon the availability of water depths, it is was proposed to develop a systematic fleet of navigation to promote the usage of Inland Waterways for transportation in our country.

IWT is the cheaper and more environmentally friendly means of transport therefore introduction of Water Transport facility creates boom in regional economics.

The main objective of proposed research is to identify impact of introducing new mode i.e Inland Water Transportation system in Varanasi region, findings of research will access possibilities of regional economic growth due to growth of IWT sector at Varanasi.

¹ WIT Transactions on State of the Art in Science and Engineering,
Vol 86, © 2015 WIT Press, www.witpress.com, ISSN 1755-8336 (on-line)



(Fig No.79. Indicating Study Area “IWT Impact on Regional Economic Development of Varanasi”)

4.1 Prototypical Share of Vehicle Populations Traffic at Varanasi.

The model traffic survey has been conducted along all three bridges connecting eastern & western banks of river Ganga at Varanasi, the main objective for conducting primary survey is to access the percentage of different vehicular types are sharing city roads, the model traffic sharing with different vehicle populations types easily identified through peak hours traffic surveys.

Inland Water Transport services offerings regional connectivity facilities to the local populations living on the opposite banks, therefore conducting primary survey becomes important for understand total traffic possibilities for diversion on IWT routes at Varanasi district. This traffic diversion may impact populations using IWT modes for commuting to the city.

The regional populations at Varanasi are mostly spreads along western sides of the river i.e Chanduali, Ramnagar & Mughalsarai etc. the urban settlements of city are mainly located along the eastern bank therefore the majority of populations were commuting to the city for meeting their various economic needs. The regional vehicular traffic share is very high whereas the proposed IWT transport services may offer seamless benefit for regional connectivity.

Three bridges are connecting the city urban areas with eastern region bank area i.e Chanduali district, the development of Inland Water Transport services offers mobility benefits to local populations that daily crosses bridge for commuting to commute the city.

Therefore the context has been steted accordingly to understand what type of vehicular traffic are moving towards the city, identified various traffic peak and surge timings, Interviewed local commuters and understand about the routes assignments for emerging transport system to offers distinct economic benefits. during the survey of various Origin

and Destination pairs are identified and various traffic facts were reveals that we may also try to understand main reasons why public crosses river frequently and what were their vetted economic interest in it, we also tried to understand which are the economic activities presently carried out along the regional banks of the Ganga basin at Varanasi, how the development of Inland Water Transport system supports in economic development.

The three bridges are located along the river Ganga at Varanasi connecting eastern region with Varanasi city, every day local population were commuting to the city via only these bridges i.e Malviya Bridge located over the northern heads of the city, Lal Bahadur Pul (Baluwa Ghat Pul) is serves the traffic of middle range of the city for crossing the river and Vishwa sundari bridge is located at southern most part over NH2 that is NH connecting Allahabad to Kolkata golden quadrilateral routes



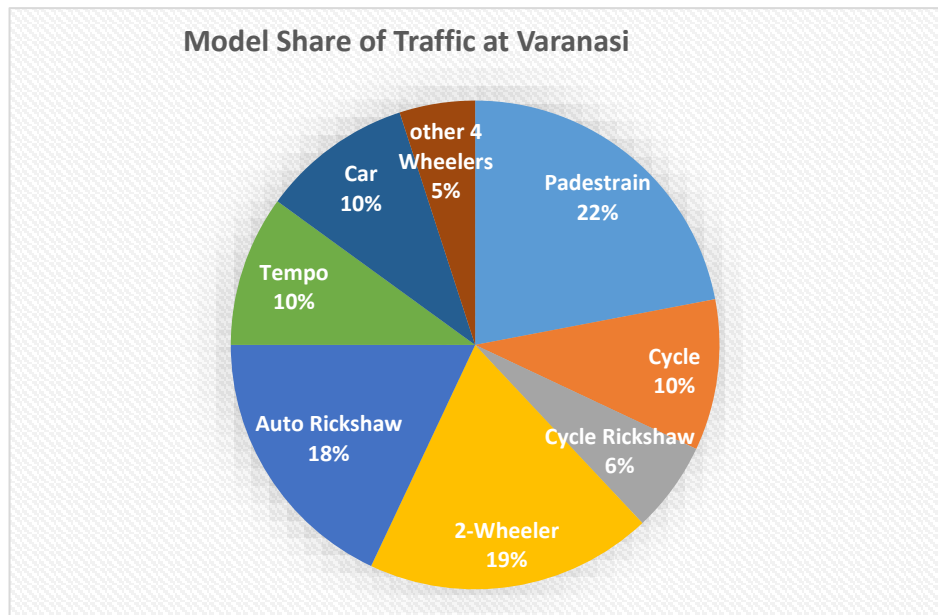
(Fig No.80. Indicative Map of three bridge connecting Varanasi city with eastern regional bank of the river Ganga i.e Chandauli district)

Conducting of traffic survey, personal interviews with the commuters, the counting of vehicular passages over the bridge helps for studying traffic movement patterns and understanding gap of existing transportation profile etc.

The assessment of local transportation needs, commuter's requirement, and identification of economic indicators helped in listing out various economic usages, pattern of mobility of local passenger, reasons why public crosses the river and where they are going and what are their needs are served while going to the city by Crossing Ganga River etc. research is trying to identify the gaps in current transportation profile of Varanasi city and how it can be met with IWT sector growth and how water transport reap out for economic incentive for local and regional populations living along the National Waterways -1 hinterlands areas.

The primary investigations were conducted to identify the percentage share of the model-mix vehicle populations recorded at important traffic nodes of the city who travels across the river, ideally the survey has been conducted along the bridges available at Varanasi and

major traffic junctions like. BHU crossing Lanka, Godowalia Markets, Shivala Silk business area, Padao crossing, Ramnanagr Chauraha, Tengra Mode, Shashtri Chowk, Varanasi Junction, Mughal Sarai, Kashi Station, Sonarpura, Telibagh and Rajatalab etc. these are the major traffic nodes selected for conducting traffic studies for understanding the transportation demand and economic activities supported by enhancing the logistics services. The peak hours of traffic selected for conducting observations during Morning, afternoon & evening time at the various important intersection nodes are surveyed and access the cumulative traffic counts and understand the patterns of vehicle percentage types propel in the Kashi city.

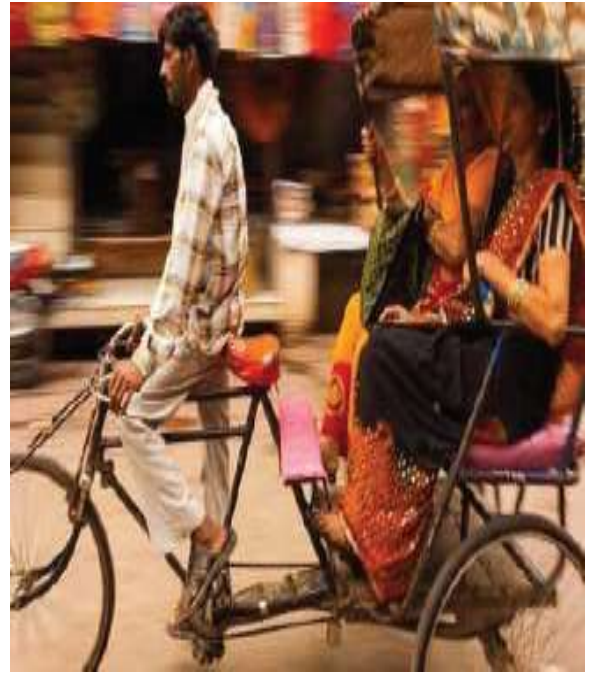


(Fig. No. 81. Model Share of Traffic at Varanasi)

It is observed the Varanasi city has model mix of various kinds of the traffic, the traffic data collected for the week of at least 1 hrs in each timings at the major junctions/Crossing/Chowk of Varanasi as indicated above.

The city traffic nodes were found congestions of traffic, there is substantial variations was also observed in the traffic of Vehicles during peak hours and normal hours, the vehicle counts were used for also understanding the passenger counts based upon the approved seating capacity of the vehicle.

Pedestrian, two wheeler and Auto Rickshaw having approx. 60 percent of the vehicle traffic model share, it was observed during the primary survey. Therefore these populations can be easily served with help of Ro-Pax vessel that propel over the river Ganges. It is clear Indicator that the city transportation profile is based upon the paratransit modes and still at Varanasi city has not operationalized any standard and formal modes of transports.



(Fig. No. 82 Traffic of Varanasi City & Paratransit mode of local transport)

Public transportation of Varanasi city is highly depended upon the motorized shared para-transit (temp and autos) were the predominant in nature, generally the trips were shared among the passengers travelling from one intersection to another, the populations travelled for varied reasons i.e Business, Jobs, Health, Education, Govt. official works, courts, tourism etc.

The riders percentage of using two wheelers and cycle utilizing the shortest routes for travel within the city, the connecting roads were used by them to reach the destination within shortest distance and reduced time, hence this shared traffic can also use the riverine transport for saving cost and time.

Average cumulative primary traffic data recorded in survey for every 15 minutes duration during peak hours (Morning, Afternoon & Evening)

Cumulative Avg. no Count for every 15 Minutes during peak hours.	Pedestrian	Cycle	Cycle Rickshaw	2-Wheeler	Auto rickshaw	Tempo	Car	Other 4-Wheelers
Major Traffic Nodes								
<i>BHU-Lanka Cossing</i>	140	70	25	100	96	93	74	32
<i>Godowalia Market</i>	110	60	34	105	95	75	54	23
<i>Shivala Market</i>	100	50	20	66	76	35	24	21
<i>Padao Crossing</i>	90	45	30	103	98	45	35	24
<i>Ramnanagr Chauraha</i>	85	50	15	65	74	38	25	22
<i>Tengra Mode</i>	60	45	18	45	55	45	45	19
<i>Shashtri Chowk</i>	75	25	10	57	67	19	28	15
<i>Varanasi Junction</i>	110	45	32	104	98	35	75	21
<i>Mughal Sarai</i>	100	28	38	98	81	37	55	22
<i>Kashi Station</i>	105	27	35	89	85	28	25	18
<i>Sonarpura</i>	45	15	15	45	25	18	22	10
<i>Telibagh</i>	55	10	10	35	15	22	21	8
<i>Rajatalab</i>	25	30	18	38	35	10	17	15

(Table No.14.The above table content representing primary traffic data recorded model share of vehicle during peak hours at major junction, the data is tabulated on average cumulative basis in three peak hours traffic i.e Morning, Afternoon and Evening)

4.2 Assessment of Cargo Market Potential for Varanasi region: ²

The IWT Multimodal Terminal at Varanasi is located near to the proximity of National Highway 7 i.e part of golden quadrilateral network of National Highways connecting four major metro cities (Delhi in Northern India), (Kolkata in Eastern India), (Mumbai in Western India), (Chennai in Southern India) and other cities is also connected with this major networks of highways. Hence, the MMT Varanasi location is very critical in terms of shifting of cargo from existing surface mode of transport to National Waterways.

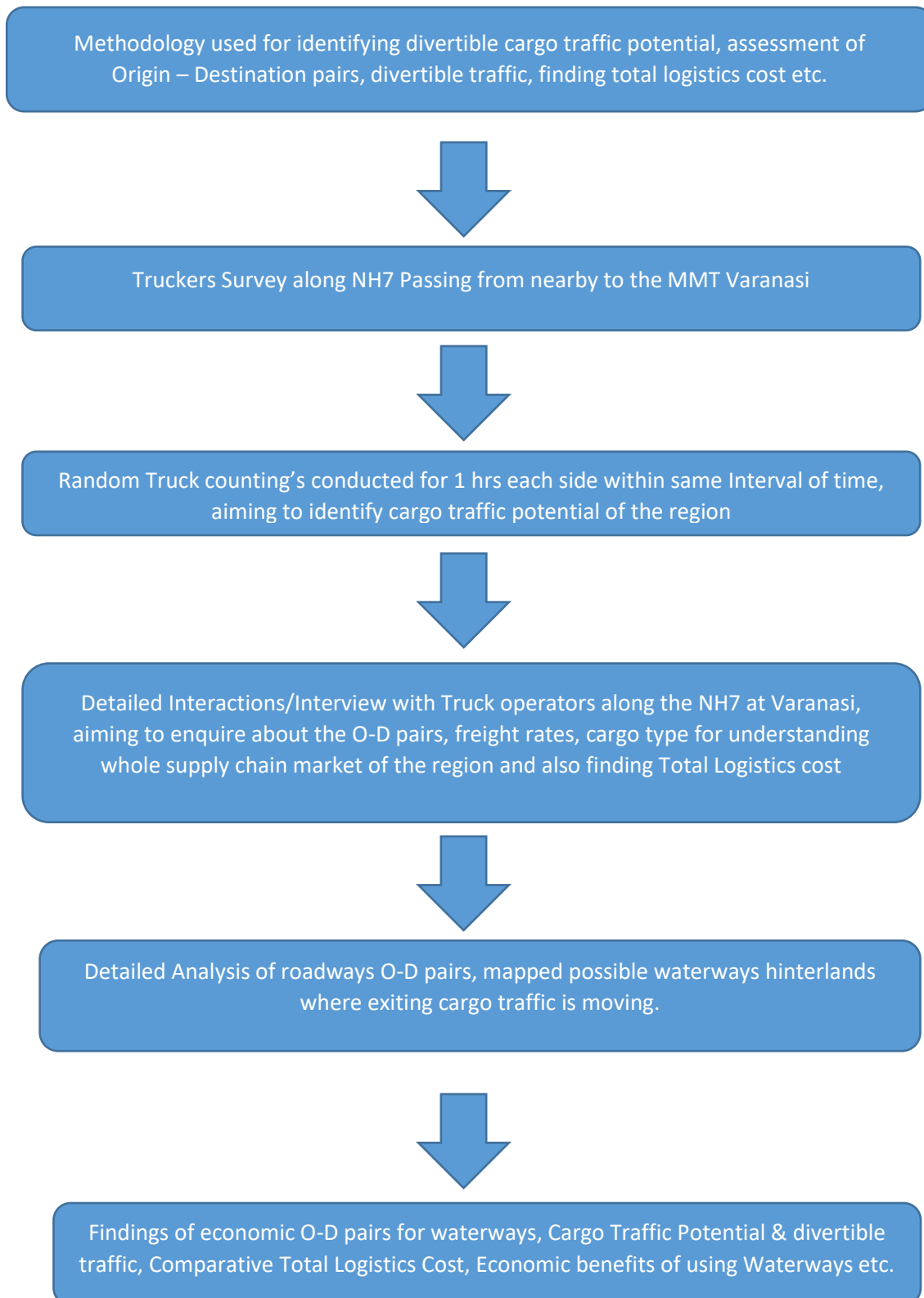


(Fig.83. Google Earth Satellite View of Multi Model Terminal at Ramnagar, Varanasi)

In the site view it is clearly indicated that MMT Varanasi is developed just beside to the road passing in downstream of the planned terminal, the Vishwa Sundari Bridge of NH 7 is available there, hence it is very important nodes for diversion of cargo at Varanasi region.

² Google Earth Satellite View of Multi Model Terminal at Ramnagar, Varanasi

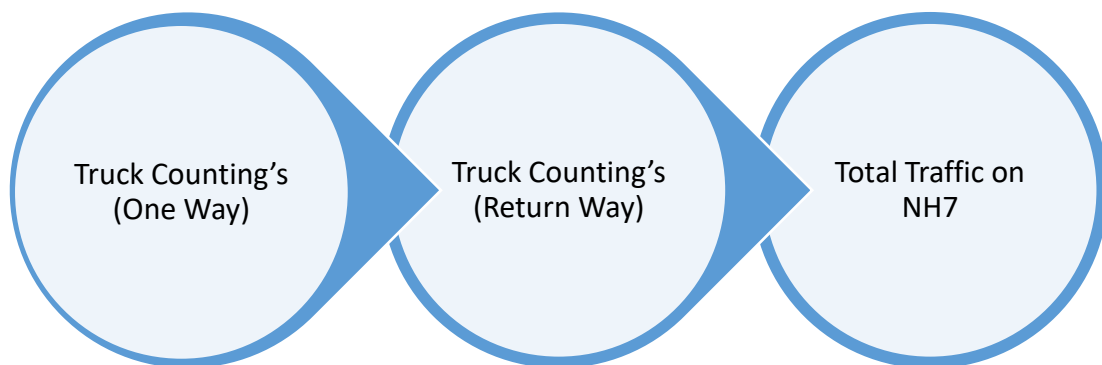
4.2.1 Method used to identify eligible Origin & Destination Pairs, Divertible Traffic, Cargo Type, Cargo Potential and Comparative Logistics cost with IWT & Roadways:



(Fig No.84)

The truck counting survey helps in understanding the total profile of logistics traffic passing through the existing modes of transport and the upcoming terminals is located at strategic point therefore cargo shifting possibilities exist here for National Waterways. The carriage truck counts survey conducted on hourly basis in four different timing of the day, hourly truck counting helps in tapping for the idea of traffic loads, cargo type, identification of Origin and Destination pairs etc.

Key information regarding cargo movement patterns for existing modes of transports are identified, further the detailed interviews are conducted with the truck drivers along the various Dhabas on the NH7 aiming to gather qualitative information's of supply chain sources, assessment of existing freight rate, return loads possibilities, distance, time and other related constraints to be identified.



(Fig No.85. Process adopted for identifying regional traffic)

The development of Inland Water Transport infrastructure at Varanasi majorly aims to provide alternative logistics supports to the region, as the exiting modes of transport are already reached to its maximum capacity utilization, whereas new opportunity required to be explored in terms of Inland Shipping. The expansion of roads required lots of land and expansion of rails are very cost factor and national demand for logistics are continuously increasing exponentially with the

Rate of GDP growth, therefore it is expected that rise in trades demands for effective logistics management is needed, the exploration of water transport could be the feasible options at Varanasi region.

Truck Passing through the National Highway - 1 Ramnagar Bypass Road, Varanasi NH 7				
Morning, Afternoon Counts				
Time	5:00 AM -6:00 AM	09:00 AM to 10 AM	12:00 PM to 1:00 PM	3:00 PM to 4:00 PM
Towards Allahabad	100 Trucks	120 Truck	90 Truck	111 Trucks
Towards Mughalsarai	85 Trucks	132 trucks	87 Trucks	125 Trucks
Evening & Night Counts				
Time	6:00 PM to 7:00 PM	9:00PM to 10:00 PM	12:00 AM to 1:00 AM	3:00 AM to 4:00 AM
Towards Allahabad	116 Trucks	140 Trucks	126 Trucks	122 Trucks
Towards Mughalsarai	110 Trucks	80 Trucks	87 Trucks	115 Trucks

(Table No.15. Truck counts survey was conducted for both ways Up and Return in different Timings along the NH7 passing through MMT Varanasi)

During the survey of market assessment at Varanasi region for IWT sector, the random survey sample was conducted where the responses collected from 150 trucks operators playing in the region.

Along NH7 there is toll plaza and various Highway Dhabha where long routes trucks parks, therefore it was decided to conduct random interview with them to understand the supply chain of their current mode and identify the cost economics and demand shift for Inland Water Transport at Varanasi.

In the above table it is clearly indicated that current roadways mode of transportation is at fully utilized in the region and due to various other factors, the shippers, freight forwarders were looking for alternate mode of cargo transportation.



(Fig.86. Truck Movement in Varanasi Region passing through NH7)

Assumptions: Railways is already established mode of transport, therefore there is very minimal chances of diversion of the traffic from Railways to IWT in current scenario at Varanasi region, however in long run for first and last mile connectivity advantages may be offered with railways from MMT Varanasi, but it depends upon the market responses of future planned developments. Normally the cargo of railways are not possible to be diverted due to additional handling costs. Presently the road transport cost is very high and various operating factors can lead for diverting cargo from roadways to waterways. Therefore, the assessment of eligible O-D pairs with roadways can be best worked out for waterways cases.

Whereas for Air Cargo, the assessment never being matched with case of Inland Water Transport due to associated demand factors required fast transportation need with Air Cargo. The transportation of cargo with Inland Waterways is having time constraints. Hence the air cargo traffic is excluded from assessment.



(Fig.87. Survey Vessel of Inland Waterways Authority of India birth at Floating Pontoon at Ramnagar, Varanasi)

4.2.2 Identified Origin and Destination Pairs & Divertible Cargo Potential:

The preliminary interactions with truck operators and traffic survey of currently playing trucks along NH 7 at Varanasi region has reveal the details of various Origin – Destination pairs that may possibly use in future water transport for cargo handling.

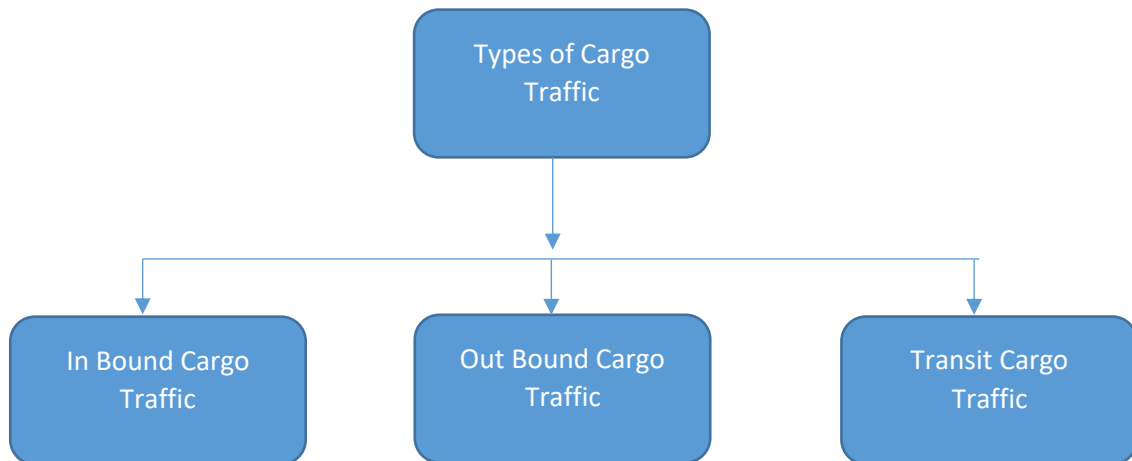
The truckers survey has given lead to identify the key node locations of National Waterways - 1 where the exiting mode of transports are used for supply of freight, with development of Multi-Modal facility at Ramnagar, Varanasi may use by the cargo owner, shipper and transporters for managing logistics along those identified hinterlands.

The 150 random sample has taken to make assessment of the freight market of the region, Truck operators are primary source of information to understand complete logistics chain of region.

During survey it was found that Varanasi region has three different types of cargo/freight traffic are available i.e Inbound, outbound and transit traffic. The 150 random sample of truck survey

and interview has helped in collecting qualitative and quantitative data on transport. Respondent has also given various suggestions of improving present transportation modes, their main expectations are with Inland Water Transport services in saving cost and time.

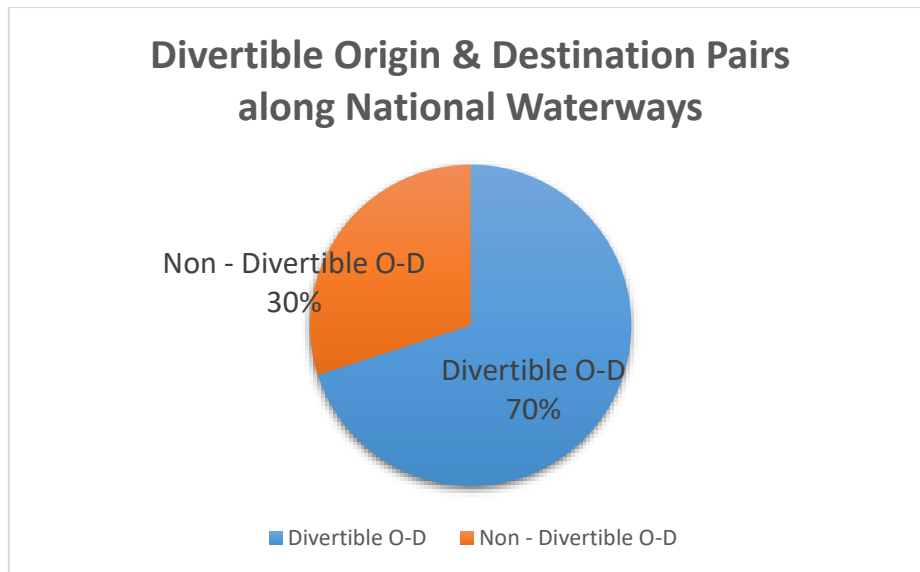
4.2.3 Types of Cargo Traffic Identification in Varanasi Region:



(Fig. No. 88. Types of Cargo Traffic Identification in Varanasi Region)

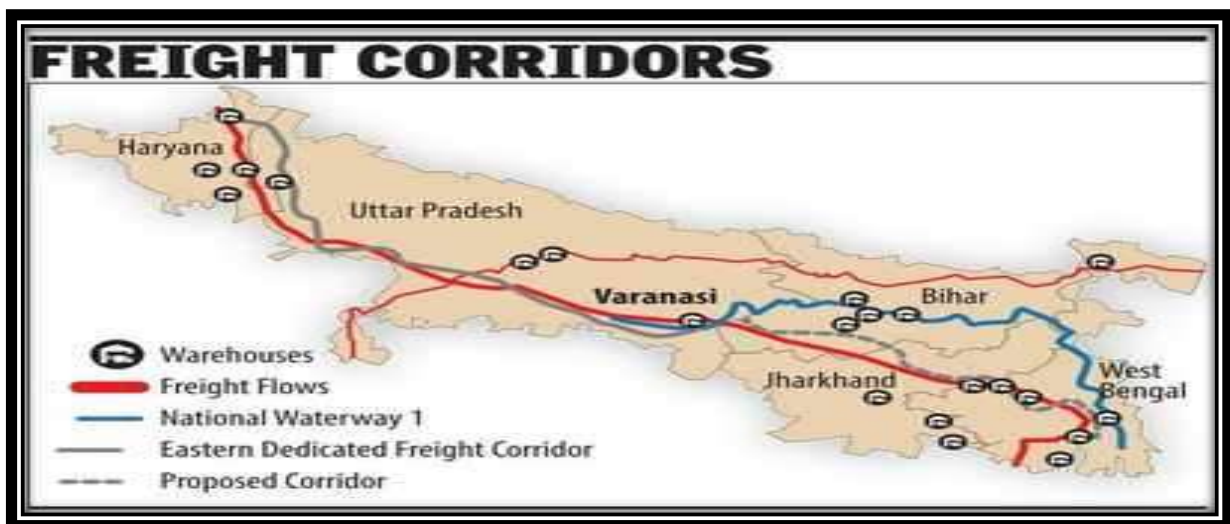
4.2.4 Finding of Divertible Cargo Traffic on Waterways at MMT Varanasi:

Out of 150 random sample survey taken along the NH 7 the data 'of traffic passages reflects that 70 % of the roadways traffics are moving along the various origin - destination pairs of the hinterlands of National Waterways – 1, now it is clear that, the said traffic can be possibly diverted along the various routes of National Waterways from identified O-D pairs during the random survey.



(Fig No. 89. Pie Chart reflecting the possibilities of diversion of exiting cargo traffic along the routes of National Waterways -1, Source: Primary Survey Data Analysis)³

Varanasi region is situated at important node for the perspective of cargo traffic movement in India, region is located in middle part of country and it provides access for passage of cargo traffic from Northern India, Eastern India, and Western India & Southern India etc. Geographically for logistics handling point of view Varanasi region is located in the middle part of nation, where cargo aggregation, cargo transfer and multimodal hubs can be developed to improve logistics performance of India, therefore this region are best suited for development of IWT Multi Modal Terminal and Freight Village including Industrial Cluster and Logistics Park.⁴



(Fig.90. Indicative Freight Corridors and Freight Flows Pattern in region, Source: News article published in Times of India, 01 June 2017)

³ Primary Survey -Data Analysis

⁴ News article published in Times of India, 01 June 2017

Varanasi is also located in the middle of Ganga Valley of Northern India, Eastern part is the state of Uttar Pradesh and Gateways for Bihar, Madhya Pradesh, Jharkhand and Bihar State.

Varanasi is located 800 Kilometres South East of New Delhi i.e 800 Kms, Lucknow is 320 kilometres, 120 Kilometres from Prayagraj and region crosses through agricultural, Industrial and Cultural lands where possibility of many opportunities.

Varanasi region is frequently encounter with shoots of traffic pressure regularly, that increases commercial activities in region and simultaneously created scope for commercial cargo traffic movements, the regional railways is also operating successfully to handle freight traffic, therefore the strategically planned development of Dedicated Freight Corridor by Ministry of Railways may help in decongesting the traffic of surface mode of transport and supports in environmental control.

4.2.5 Rare Phenomena of the World - Four different modes of Transport Integrates at Varanasi

Inland Water Transport sector is developing logistics infrastructure and transportation estate of region that helps to convert Varanasi region in greater economic cluster, many international competitive companies has shown their interest for Investment in the region.

Varanasi MMT region has proximity to the city where distribution and supply of cargo can be made and also the region will serve as distribution centre, point of transfer of freight for long distance transport.

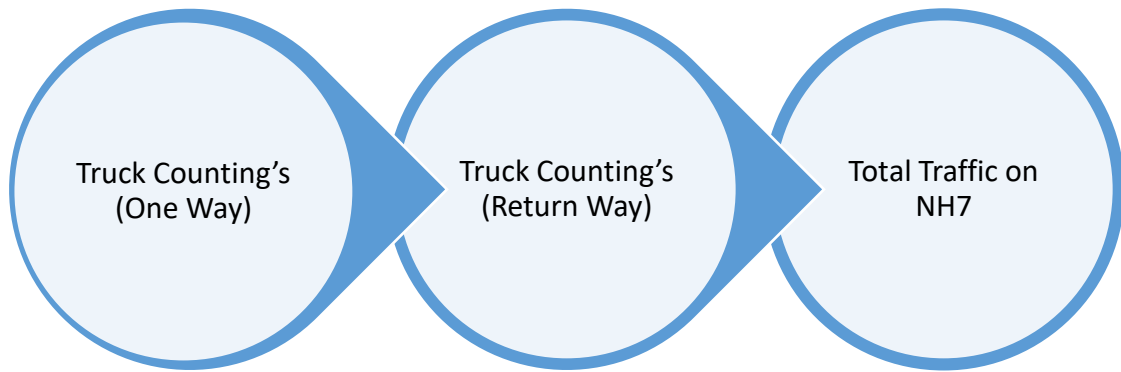
MMT Varanasi located on the node where Shipper has choice of selecting four different modes of transport i.e Railways, Roadways, Airways and Waterways. Such a great integration are rarely found in the World. ⁵



(Fig No. 91 “A rare possibilities of the World, Four different modes of Transport Integrated at MMT Varanasi”)

⁵ Research Findings – Primary Assumptions of Research.

4.2.6. Derivation of Logistics Traffic and Cargo Movement Patterns along the corridors of NW-1 and Multi Modal Terminal Varanasi. ⁶



(Fig. No. 92. “Assessment of cargo traffic movement nearby nodes of MMT Varanasi, via through NH-7”)

The assumptions has been taken for the accounting cargo traffic movement currently happening through roadways nearby node of MMT Varanasi i.e National Highway 7. The possibilities for shifting cargo from roadways to waterways are more happening due to the increased total logistics cost. However the cargo transported through railways were also diverted but due to the constraints of railways operations and rack availability and time factor etc.

However, Inland Water Transport sector is at very nascent stage and the most of the industries logistics models are prepared as per the suitability of existing modes of surface transport i.e railways and roadways. But inclusive of water transport required additional handling cost but having several other benefits, therefore detailed industry consultations conducted and interviews with local chamber commerce conducted to find the best suited cargo and Origin and Destination pairs that offers edge in handling of the logistics.

⁶ Assessment of cargo traffic movement nearby nodes of MMT Varanasi, via through NH-7

4.2.7. Assessment of traffic potential in respect to Varanasi MMT region:

Parameters considered for calculating market Traffic for roadways at Varanasi region		Towards Prayagraj (A)	Towards Mughalsarai (B)	Total (A+B)
STEP 1	Cumulative counting's of trucks Movement (Morning + Evening) total counting's for 8hrs in different timing in a day	978	752	1,730
STEP 2	Average number of truck passes NH 7 per hour	122	94	216
STEP 3	Assessment of total truck passes NH7 in 24 hrs.	2,934	2,256	5,190
STEP 4	Considered average truck loading capacity is 22 MT for calculating total freight passes through Varanasi region in MT	64,548	49,632	1,14,180
STEP 5	Considered assumptions of 50% of empty returns during calculating traffic moved per day (MT)	32,274	24,816	57,090
STEP 6	Total Yearly Traffic	117,80,010	90,57,840	208,37,850

(Table.No.16. "Assessment of Regional Cargo Potential)

The above six steps methodology has been followed for measuring regional market cargo traffic, as roadways traffic are more likely to be divertible on waterways, but condition to the Origin-Destination pairs of exiting traffic movement patterns matches freight flow patterns with IWT.

As per the detailed survey of truck survey leads to identify the total regional traffic available at Varanasi region is approximate 20.8 MMTPA (Million Metric Tons Per Annum)

Assumptions:

The consideration of roadways traffic has been taken into the accounting for precise assessment of regional cargo potential in Varanasi. It is very difficult to divert the traffic of railways to waterways due to onsite rail sidings connectivity saves the handling cost of end to end transport first mile and last mile connectivity. Therefore, railways has always edge over the waterways, so the assumptions of roadways traffic is more precise in case of MMT Varanasi.

But in future development of Dedicated Freight Corridor Upto Varanasi MMT the export cargo may diverted in future, but as on date the DFCCIL project is under implementation only, hence we can't access the traffic of railways. MMT Varanasi have still not connected with railways, and it has provision in future expansion phase, therefore the under development of IWT sector presently shift the roadways traffic only.

4.3. Major Commodities Transported through Varanasi Region:

Following major commodities are identified based upon primary and secondary survey data, mapping local industrial demands of raw materials, supply, market assessment and mapping of other local consumptions:

Coal: The demand for coal at Varanasi region is very high always, therefore during primary survey of trucks and transporters we have identified coal as major commodity that transported to Varanasi from Jharkhand.



Chandpur Industrial Area, Ramnagar Industrial Area and Varanasi SEZ etc. having regular requirement of coal as raw material. However major power plant NTPC, fertilizer plants IFFCO and Cement Industries Jaypee group and Hindalco having requirements of major share of coal in region.

The demand of imported coal is also available for specific use in iron casting and smelting, they requires imported coal for getting high calorific value.

At Varanasi having Asia largest Chandasi Coal Mandi where mainly coal trade occurs, therefore coal identified as major commodity for transportation and best suited with IWT mode.

Construction Material:

Varanasi region is developing region and it is major node of market place in eastern Uttar Pradesh, the presence of major power plants, cement industries and cement packing units provides the opportunity for transportation and aggregation of construction material at Varanasi MMT



Agriculture Aggregates:

Agriculture is the prime economic activity along the hinterland of river Ganga, Varanasi region and nearby district having larger area under agriculture, therefore, the transportation and warehousing needs for agriculture inputs and outputs exist.



Food Grains and bagged products:

Northern plains produces rice, wheat and pulses and largest area are under agriculture, therefore demand of transport and market of warehousing required in this region for food grains.

Edible Oil:

Varanasi region has several oil refining and processing industries, many MSME sectors are working in the region for extraction and refining of edible oil, the major player is JVL Agro Ltd. that producing edible oil and supplying it internationally, therefore this cargo can be important for the region and may logistics demand can be shifted on Inland Water Transport.



Cattle Feed:

The regional economy of PURVANCHAL is agriculture based, the cattle rearing is associated secondary sources of income of the farmers, the Varanasi region and nearby district headquarters have several Milk Mandis and Cattle Mandis etc.

The entrepreneurs has identified the business opportunity for cattle feed and established the manufacturing units to meet the demand of cattle feed. Possibly this can be a major commodity that requires storage and distribution supports through Inland Waterways, cattle feeds having more demand in rural areas, and the National Waterways – 1 hinterlands have agrarian society along its both bank. Hence, the supply chain and distribution with National Waterways for cattle feed is best suited to these industries



Following were the major players of cattle feed manufacturers of Varanasi region.

- a. Godrej Agrovet Ltd. Varanasi, Varanasi Cantt
- b. Agrawal Enterprises. Varanasi, Ashapur
- c. Sardar Cattle Feed. Khanna, Kauri
- d. Jai Kisan Agro Products. Indore, Rnt Road
- e. Patidar Cattle Feed. Morbi, Chachapar
- f. Shri Avdhut Industries. Karad, Karad
- g. Agribegri.com. Rajkot, Harihar Chowk
- h. Kisan Fodder Mills Pvt Ltd.

Containers:

Containers shipping are in demand through the Varanasi region due trade and commerce of the region increases export and Import that spikes demand of container transportation. IWT based container transport facility has played vital role in increasing efficiency of logistics and cargo handled safely. The transport Infrastructure investment and enhancement of ancillaries facilities like stock yard, warehousing and container stacking facility etc. being easily performed at IWT port Varanasi.

The containers transportation will be highly handled at MMT Varanasi and ease of ports access, facilitate shippers for International shipping, establishing supply chain model through upcoming river port may help in achieving economic goals of the country. The 20 TEUs and 40 TEUs capacity containers can be easily handled at riverine port at Varanasi through MHC crane.



Inland Waterways Authority of India has tested the national waterways but conducting historic pilot movement along National Waterways -1, 16 TEUs of containers was transported from Kolkata Gr. Jetty to Varanasi MMT by using IWT vessel MV RN Tagore. Hon'ble Prime Minister of India himself has received the container cargo of PEPSICO at MMT Varanasi on 12.11.2018 and inaugurated the newly constructed IWT terminal along NW-1.

Thereafter, this event many successful pilot runs of containers were done and in lower stretches of National Waterways – 1 the container transportation are well established. Containers transported to Nepal, Bhutan and Bangladesh are also easily transported through waterways. Therefore containers are one of the very important cargo traffic for the MMT Varanasi and entire national waterway.⁷

4.4 Identification of Key Origin - Destination Pairs and Cargo:

The primary survey was conducted with truckers along highway, cargo owners, freight forwarders, warehouse owners and transports of the region. Out of total samples collected the approximately 70% of the O-D pairs are identified for diversion of their cargo are possible. These origin – destination pairs are well aligned with National Waterway-1 hinterlands. (River Ganga basin)

The following O-D pairs, Cargo and suitable IWT Port of loading and IWT Port of discharge details are given below:

Origin	Origin Port	Destination	Discharge Port	Commodity
GHAZIPUR	MMT VARANASI	BHUWANESHWAR	GR JETTY KOLKATA	BIKE
MAJHIGWA (M.P)	MMT VARANASI	BAKUDD (West Bengal)	GR JETTY KOLKATA	Mustard Seeds

⁷ India Maritime plus brochure published by Ministry of Shipping, Govt. of India

Jamshedpur	MMT SAHIBGANJ	Lucknow	MMT VARANASI	Window
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Stationary Items
Jharkhand	MMT SAHIBGANJ	Rajasthan	MMT VARANASI	Iron
Orissa	GR JETTY KOLKATA	Kathgodam	MMT VARANASI	Bearings
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Bamboo
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Oil lubricant
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Paper
Patna	GAAY GHAT TERMINAL	Allahabad	MMT VARANASI	Iron Rods
Varanasi	MMT VARANASI	Bhagalpur	IWT JETTY BHAGALPUR	Cement
Siliguri	FLOATING TERMINAL FARAKKA	Varanasi	MMT VARANASI	Plywood
Dala	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Cement
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Machinery Parts
Gurugram	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Car
Jamshedpur	MMT SAHIBGANJ	Meerut	MMT VARANASI	Steel
Kanpur	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Tyres
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Sarees & Cloth items
Kanpur	MMT VARANASI	Guwahati	PANDU JETTY	Iron Sheets
Kanpur	MMT VARANASI	Asansol	GR JETTY KOLKATA	Furniture
Ghaziabad	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances
Noida	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Cloths
Mumbai	MMT HALDIA	Varanasi	MMT VARANASI	Machinery Parts
Varanasi	MMT VARANASI	Mumbai	MMT HALDIA	Carpet
Gurugram	MMT VARANASI	Dibrugarh	PANDU JETTY	Motor Bike

Haryana	MMT VARANASI	Guwahati	PANDU JETTY	Food Grains
Punjab	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Agriculture Equipment's
Chandigarh	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Chemicals Products
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Paper
Kanpur	MMT VARANASI	Haldia	MMT HALDIA	Rubber & Leather
Allahabad	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Fertilizer
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tea leaves
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tick Woods logs

(Table No.16.1. List of O-D Pairs & Cargo Type Identified by Research Investigation)

4.5 Varanasi region emerges for Hub-Spoke Logistics Model: ⁸

In research study it was identified that Varanasi region caters as hub and spoke model of logistics handling for the country. Geographically the region falls in centre of Eastern India and Northern India and also intersect transport chain for central and southern and north-eastern parts of the country. Therefore Varanasi region has significance in handling logistics. The development of National Waterways – 1 (Ganga-Bhagirathi-Hooghly river system) and construction of Inland Water Transport Infrastructure has made Varanasi as more preferred destination of cargo aggregation and transportation.

Emerging of Varanasi region as hub & spoke model of logistics network.

The development of riverine port over river Ganges, offers seamless connectivity for supply chain management.

⁸ National Transport Development Policy Committee report on INDIA TRANSPORT REPORT MOVING INDIA 2032 published by Routledge in 2014.

This design of logistics are well suited for MMT Varanasi due to geographical significance.

Varanasi MMT is well connected with all major four modes of transport, therefore shippers, cargo owners, manufacturers, transport owners and freight forwarding companies have all options to choose mode of transport as per their needs and requirements. Varanasi MMT location is very unique in itself, it offers rare integration of all modes of transport at one place. MMT Varanasi in future plays pivotal role in handling logistics of new India.



(Fig. No. 94)

NW-1, together with the proposed Eastern Dedicated Freight Corridor (EDFC) and a number of National Highways (NH-1, NH-2, NH-80 etc.) constitute the Eastern Transport Corridor of India, connecting the National Capital Region with Kolkata, the seaport gateway of India to the Bay of Bengal.

The total freight flow generated from or destined to the six States in the corridor is about 40% of the overall flow of cargo in India. In spite of a significant difference in geographical distance, the States of Bihar and Uttar Pradesh prefer the western sea ports of JNPT and Kandla over the Kolkata Port, while the port usage for Jharkhand is equal between the western ports and Kolkata. This is largely due to the limited choice of transport mode, poor hinterland connectivity and to some extent, sub-optimal port infrastructure and efficiency in Kolkata Port. On the other hand, West Bengal and the hinterland have the potential to become the gateway for trade with the East because of its close proximity to Orissa and Chhattisgarh (one of the major mineral belts of India), access to North East Region and link to Bangladesh, Myanmar, Thailand, Nepal and other east and south-east Asian countries. In order to incentivise movement of substantial portion of cargo from the western ports to the Kolkata port and to the rapidly growing Paradip and Dhamra ports in Odisha and to open up vast opportunities in inland as well as ex-India movement of cargo through this transport corridor, NW-1 is being



developed with the necessary infrastructure and assured depth in the navigational channel through the Jal Marg Vikas project, which will function in tandem with the proposed EDFC and a number of National Highways. Varanasi has a locational advantage, as it has a vast agrarian hinterland with proximity to NH-7/NH-2 and EDFC. The multimodal terminal at Varanasi, with connectivity to NH-7 and to the EDFC through the Jeonathpur railway station, is expected

to serve as a focal point in the logistics chain of Eastern Transport Corridor of India with complementarity amongst Inland Waterway, road and rail modes of transport.

4.6 Plan for development of Integrated cum Logistics Park (Freight Village) adjacent to the IWT Port at Varanasi. ⁹

Government of India has planned for implementation of standalone project just adjacent of the Multimodal Terminal Varanasi, it is proposed that approximate 100 acre of land near to the MMT Varanasi will be developed as Freight Village.

Varanasi is strategically located at focal point in the logistics chain of Eastern Transport Corridor of India, as the NW-1; EDFC; and NH-7 and NH-2 pass through/near Varanasi. The current traffic volume in the region is negligible. The IWT Sector Development and Business Development Study commissioned for Jal Marg Vikas Project has projected a phenomenal increase in the traffic volume in the region when the JMVP and EDFC are commissioned.

In order to handle this increase in volume of traffic, a multimodal terminal with road connectivity to NH-2 and rail connectivity to Jeonathpur railway station on the EDFC, is being constructed/proposed to be constructed in two Phases.

On completion of this project, all the three modes of transport which are converging at Varanasi (i.e. the Inland Waterway, road and rail modes of transport) would work in tandem to bring about complementarity between each of these modes of transport and also give the cargo operators/shippers the option to choose the right mode of transport suiting them.

The Freight Village is proposed to be set up near the multimodal terminal at Varanasi with the objective of creating a logistics hub, wherein the logistics' companies and water related manufacturing & trading companies are brought under one roof by allotting land on lease so that a productive logistics neighbourhood is established and ease of doing business is enhanced. The Freight Village will also provide support to stimulate development of a professional logistics industry in Varanasi.

Presently, there is no logistics centre at the IWT terminal at Varanasi. After the multimodal terminal is commissioned, vessels with the capacity of up to 2000 DWT would be able to berth at the IWT terminal and will have the infrastructure facilities required to handle the expected increase in the volume of cargo traffic from JMVP and EDFC through synchro-modality. The logistics' companies and water related manufacturing & trading companies in the proposed Freight Village near the multimodal terminal will establish a productive logistics neighbourhood and enhance ease of doing business.

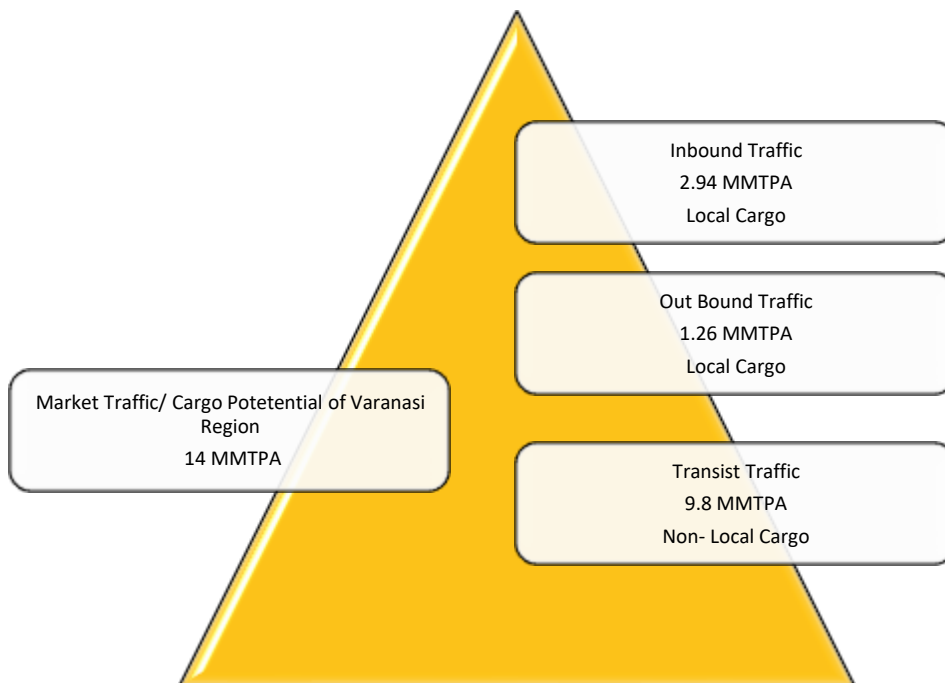
The proposed Freight Village at Varanasi will attract logistics' companies and water related manufacturing & trading companies to Varanasi and establish a productive logistics neighbourhood and enhance ease of doing business as in the case of Specialized Economic Zones. The Freight Village will also provide support to stimulate development of a professional logistics industry in Varanasi.

⁹ Monthly bulletin on foreign trade statistics, April 2018, published by Ministry of Commerce and Industry

4.6.1 Different types of divertible cargo at MMT Varanasi i.e Inbound, Out Bound & Transits Cargo.

Varanasi region is upcoming as Cargo aggregation hub and the transport industry are likely to be flourished the local economy the area. Primary interaction with local stakeholders and chamber of commerce it is accounted that out to total addressable cargo of the region is estimated as 14 MMTPA out of 20 MMTPA i.e 70 percent of the cargo of the region may likely to be diverted on National Waterway-1

The willingness of shifting and use of the Inland Water Transport was also gauged through primary interactions. Varanasi is emerges as transshipment hub by construction of Multimodal terminal along with Freight Village (Integrated Cluster Cum Logistics Park) a kind of special economic zone.



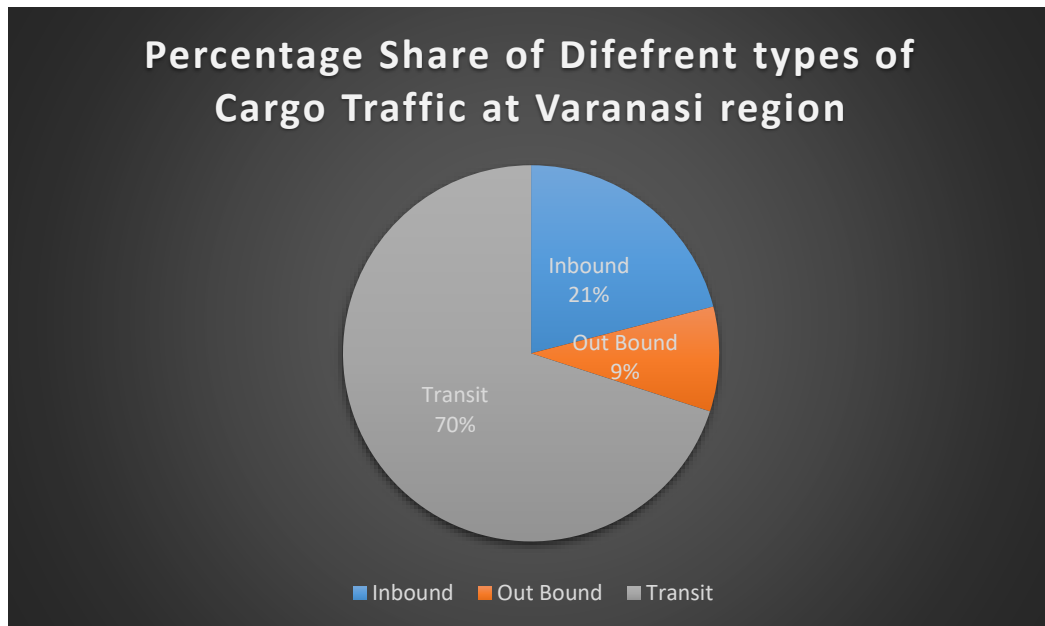
(Fig. No. 95 Estimation of different types of divertible cargo for MMT Varanasi Riverine Port)

The Primary survey has help to identify approximate 20 MMTPA of freight volume that can be divertible through Varanasi MMT, based up on primary data analysis, O-D pairs of NW-1 hinterlands are matched with current traffic flows and derived different types of traffic volumes are catered by the Varanasi region.

Promotion of Inland Water Transport will be further ease by analysing the needs of traffic, cargo origin – destination pairs, cargo originating from the region, cargo destined in region and cargo passing through Varanasi.

The classification of local and non-local cargo is identified based up on the types and nature of freight flows. The local cargo classified as cargo Originated and destined to the Varanasi and Non-local cargo are identified as cargo passing through Varanasi region i.e transits cargo.

Understanding the supply chain and logistics of the region through primary survey it was identified that the total divertible freight size at Varanasi region is 20 MMTPA. However, only 70% of the cargo can be matched with water transport O-D pairs hence only 14 MMTPA can maximum re-route through the National Waterways.



(Fig. No.96. Percentage Share of different types of divertible cargo at MMT Varanasi)

Responses derived through primary survey with stakeholders the volume of divertible cargo are identified by analysing the data compiled. The percentage out of total divertible traffic 70% of 20 MMTPA that is 14 MMTPA can be divertible/re-route through the National Waterways. Out of that 14MMTPA the 21% of traffic is destined/Imported to Varanasi region i.e Inbound Traffic, 9% of the traffic will originated for export from Varanasi region, remaining 70% traffic passes through the Varanasi region i.e Transits Traffic.

The Primary reason identified for shifting of cargo from existing mode to Waterways mode are

- a) Warehousing facility likely to available along the IWT Ports at Varanasi
- b) Reliability of Transport and cost-efficient mode can be selected with available options of different mode of transport
- c) Multimodal transport facilitated and international shipping availability along with custom clearances etc.
- d) Varanasi MMT & Freight Village together will offers one stop solutions for cargo transportation
- e) MMT Varanasi offers the facility of cargo aggregation and transshipment hub of logistics
- f) Stakeholders may use Varanasi MMT for strategic supply and distribution management of the goods, Hub and Spoke model can be adopted for Varanasi MMT
- g) Increased cargo volume can be easily handled, presently freight forwarders, shipper and cargo owners facing issues of rack availability with railways mode of transport and roadways mode of transport has so many uncertainties and operating cost are very higher

- h) IWT may use for reduction into the cost of Input for manufactures of Banaras, the reduced logistics cost helps local manufacturing units to flourish their business within competitive price bid of the produce
- i) MMT Varanasi supports for increasing logistics performance index of the country and cargo diverted through EDFC is also destined to the MMT Varanasi, therefore storage and local transport can be easily managed.

4.7 Assessment of Economical Viable Origin – Destination Pairs with Inland Water Transportation & Re-routing of Cargo through MMT Varanasi. ¹⁰

During the interactions with stakeholders, it was identified that majority of stakeholders have been using roadways mode of transportation, they organise their cargo supply with help of truck transportation, some of them uses railways mode to transport for longer distance where truck transportation is not available.

Vehicle cost has major investment in the transport as well as interest and depreciation of the capital. This fixed cost investment they incurred independently in transportation Industry.

Fixed operating cost expenses related to the wear and tear, vehicle insurance and EMI and size of depreciation of asset are determined under fixed category

Variable cost includes maintenance, repairs incurring, fuel, spares and taxes, challans and legal charges etc.

Roadways and railways modes of transportation overheads are always higher to the Waterways cost. The economics of waterways are become game changer in transportation industry.

Well prepared selection of supply chain offers better strategic advantages in reduction of cost of Input and lower the overheads cost of produced goods in supply and distribution.

A shipper needed to trade – off in between the cost and selling price, therefore cost incurring on transportation of goods are decisions factors, and the decisions of transportation impacted responsively to the whole business.

The transporter and shipper both looks window specified by the customer and make their profit within the specified limits. The rising of cost in transportation, the margin were reduced for transporter as well as difficult to get competitive transport cost to the shipper to beat competition.

During field survey the detailed information was seek on freight cost, cargo type, distance in kilometres and place of origin and destination of cargo etc.

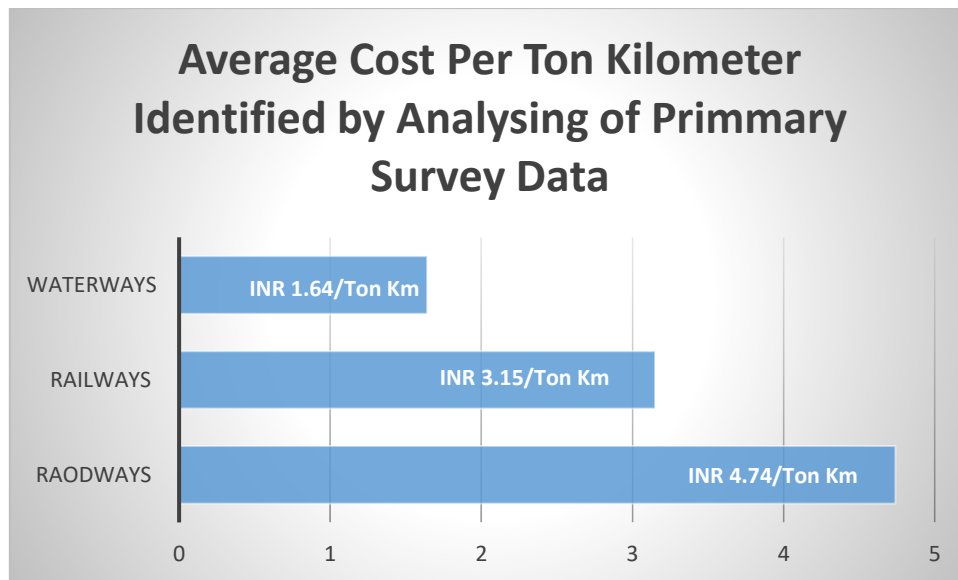
This information has led for drawing various analysis related to the transport requirements of the shipper but research inclined with objectively for Water Transportation, therefore the data set is realigned according to access the viable O-D pairs that suited for diversion along National Waterway-1

Following o-D pairs are identified economically feasible when compared with roadways and railways mode of transport.

¹⁰ Open Government Data Platform, Government of India, Web link: <https://data.gov.in/>

These O-D pairs are competitive in terms of cost, time and reliability, it was also conformed in survey that the below O-D pairs are either originated or destined with O-D pairs aligned with NW-1 hinterland areas.

With this assessment the regional demand patterns of the goods are also detected and it helps to offer the transportation facility according the goods and needs of the shipper.



(Figure No.97. Average cost with different mode of transport identified OD survey)

- Waterways Transportation cost 65% lesser of Roadways cost.
- Waterways Transportation cost 47% lesser of Railways cost

The cost of transportation for per ton per kilometre is identified based on taking the average of cost and kilometres data of origin and destination pairs that are aligned with the hinterlands of waterways.

The O-D Pairs are separately analysed for roadways, railways and waterways modes and the constraints involved in each type of transport modes are considered during the cost findings

Below table has shown the detailed O-D pairs for each routes that Identified during volumetric survey with truck operators along the National Highway-7 near to the MMT Varanasi

Based up on the primary data availability, few assumptions are considered in identifying the waterways cost. As in present scenario the IWT mode is not established therefore cost comparative data identified with help of extrapolation of data available.

The figure above clearly indicating that from all modes of transport waterways cost is lesser and economical. The development of Inland Water Transport routes from Varanasi to Haldia helps to spurt the economic growth of the Varanasi region

The analysis of primary data and its comparison with the data already published by the Ministry of Ports, shipping and waterways are showing almost similar effect. The shipper will get huge economic cost advantages with selected routes identified shift their cargo.

On an average basis the waterways cost are lesser than 50-65% with Roadways cost and comparative to railways it is 35 -47 % lesser depending upon the routs assignment and variable

factors involved. The primary survey has validated the published data by the authorities in terms of percentage cost reduction on waterways transport. However, the cost rates are different due to market factors and other competitive forces.

Tabular Analysis of Economic Viable Origin - Destination Pairs along NW-1 hinterlands by referring through MMT Varanasi as Origin Port or Destination Port

Origin	Origin Port	Destination	Discharge Port	Commodity	Roadways Cost Per Ton-Kilometre	Railways Cost Per Ton-Kilometre	Waterways Cost Ton-Kilometre	% Waterway Cost lesser than Roadways by	% of Waterway cost lesser than Railways by
GHAZIPUR	MMT VARANASI	BHUWANESHWAR	GR JETTY KOLKATA	BIKE	3.49	2.91	2.14	38.53	26.24
MAJHIGWA (M.P)	MMT VARANASI	BAKUDD (West Bengal)	GR JETTY KOLKATA	Mustard Seeds	3.66	2.72	1.93	47.31	29.08
Jamshedpur	MMT SAHIBGANJ	Lucknow	MMT VARANASI	Window	4.40	2.65	2.22	49.48	16.18
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Stationary Items	5.00	3.82	2.71	45.76	29.08
Jharkhand	MMT SAHIBGANJ	Rajasthan	MMT VARANASI	Iron	2.80	2.33	1.85	69.47	63.37
orissa	GR JETTY KOLKATA	Kathgodam	MMT VARANASI	Bearings	4.04	2.87	1.21	70.13	57.88
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Bamboo	3.45	2.55	1.17	66.26	54.21
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Oil lubricant	3.82	2.36	1.17	69.47	50.68
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Paper	4.80	3.20	1.64	65.78	48.67
Patna	GAAY GHAT TERMINAL	Allahabad	MMT VARANASI	Iron Rods	11.62	7.84	2.25	80.66	71.32
Varanasi	MMT VARANASI	Bhagalpur	IWT JETTY BHAGALPUR	Cement	7.40	4.40	2.17	70.65	50.63
Siliguri	FLOATING TERMINAL FARAKKA	Varanasi	MMT VARANASI	Plywood	6.43	5.00	1.81	71.84	63.79
Dala	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Cement	10.56	6.11	2.31	78.11	62.20
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Machinery Parts	4.80	3.10	1.64	65.78	47.01

Gurugram	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Car	4.18	2.00	1.76	81.92	62.20
Jamshedpur	MMT SAHIBGANJ	Meerut	MMT VARANASI	Steel	4.14	2.71	1.92	77.89	66.26
Kanpur	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Tyres	5.50	4.10	1.64	70.13	59.94
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Sarees & Cloth items	7.00	4.67	1.83	73.93	60.89
Kanpur	MMT VARANASI	Guwahati	PANDU JETTY	Iron Sheets	6.33	5.00	2.02	68.09	59.58
Kanpur	MMT VARANASI	Asansol	GR JETTY KOLKATA	Furniture	10.63	5.63	2.00	81.17	64.44
Ghaziabad	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances	3.18	2.00	1.76	76.24	62.20
Noida	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances	4.09	2.09	1.82	80.00	60.87
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Cloths	3.50	2.70	1.85	47.14	31.48
Mumbai	MMT HALDIA	Varanasi	MMT VARANASI	Machinery Parts	4.33	2.47	1.47	66.15	40.54
Varanasi	MMT VARANASI	Mumbai	MMT HALDIA	Carpet	4.13	3.20	2.93	29.03	8.33
Gurugram	MMT VARANASI	Dibrugarh	PANDU JETTY	Motor Bike	3.33	1.88	1.26	62.11	32.64
Haryana	MMT VARANASI	Guwahati	PANDU JETTY	Food Grains	4.25	2.75	1.75	58.82	36.36
Punjab	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Agriculture Equipment's	6.43	4.86	2.35	63.50	51.69
Chandigarh	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Chemicals Products	2.50	1.78	1.94	62.22	46.88
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Paper	5.71	3.93	2.17	62.11	44.89
Kanpur	MMT VARANASI	Haldia	MMT HALDIA	Rubber & Leather	6.18	4.09	1.68	72.88	59.02
Allahabad	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Fertilizer	7.38	4.75	2.05	72.16	56.77
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tea leaves	5.36	3.21	2.17	59.58	32.64

Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tick Woods logs	4.25	2.69	1.89	55.42	29.51
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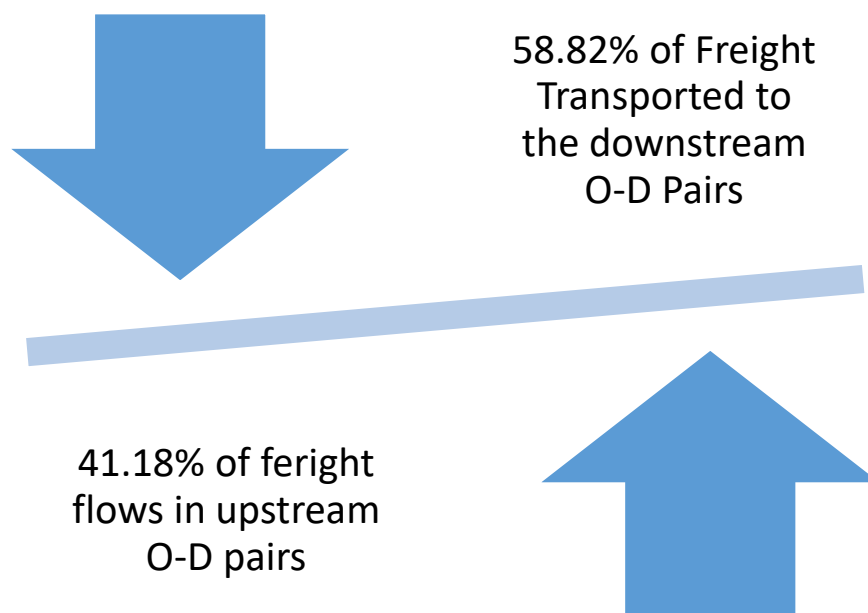
(Table No. 17. Table showing the list of viable O-D pairs, Cargo re-routing through MMT Varanasi)

4.8 ANALYSIS OF FREIGHT FLOWS UPSTREAM VS DOWNSTREAM:

The traffic assessment for Varanasi region is made through volumetric survey conducted with stakeholders i.e truck operators, warehouse owners, cargo operators, shippers and Industrial units of the region, however stretches of National Waterway – 1 is 1620 Kilometre from Allahabad to Haldia. But the study focus to understand economic impact of IWT sector in Varanasi region and how this sector may economically benefits to the area.

The study of data and approach used has revealed importation on cargo flows pattern in upstream and downstream flows directions of the river Ganga. Basically IWT Voyage directions are taken to consider the freight flows in Upstream or Downstream O-D pairs and details extracted by data crunching and mining.

The majority of freight flows pattern were identified for downstream cargo, approximate 58-60% of the freight flows pattern were in downstream. However, for upstream freight flows are limits up to approximate of 41%, hence it is clear indicator that two ways Voyage cargo opportunity are available on National Waterways -1



(Fig. No.98. Details of freight flows in Upstream and Downstream directions)

The balancing of freight flows can be made for Varanasi region by implementing Inland Water Transportation concept, initially railways mode of transport has suffered major losses in beginning stage due to empty return. Hence, the primary data reflecting for IWT sector of Varanasi region economically feasible.

4.9 Identification of Major Cargo Transported from Varanasi In Upstream And Downstream of NW-1

Varanasi is no doubt it become the logistics hub and transport industry in future will be becomes back bone of the regional economy. The construction of riverine port in Purvanchal region along with freight village at Varanasi may help in catering requirement for many stakeholders.

The local areas of the Varanasi region may likely to be engaged in main economic stream and region will become activity of special economic importance for the country.

Analysing data further has provided information on various type of cargo that transported in Upstream and Downstream directional voyage on NW-1. The details are extracted by extrapolating exiting data by matching with regional freight flows requirements likely to be catered along National Waterway-1 hinterlands.



(Fig. No.99. Identification of major cargo moved in Upstream and Downstream directions)

4.10 Inland Water Transport sector fosters regional economy along hinterlands of Ganga in Varanasi region: ¹¹

The local market of Banaras transacting in informal way, for reaching to the market places within city needs longer travel, that will be cost and well as time consuming factors in congested city like Varanasi, most of the local daily needed items like vegetable, fish & milk etc. are produced along the banks of river Ganga hinterlands.

The development of Inland Water Transport creates market linkages for regional population to supply their local produce to the city and convert Ganga Ghats as point of micro economic exchanges for income, distribution and revenue for trade and commerce.

The alluring Ghats of river Ganga at Varanasi is the major local attractor; therefore, millions of populations visit to the river side. The landscape transactions with spiritual and religious activities were performed at Ghats of Varanasi recognises the shore side land usage for religious, commercial and economic activities.

¹¹ Director General of Shipping, Government of India, web link: <http://www.dgshipping.gov.in/>

The Inland Water Transport lead for increasing the mobility of passenger traffic along the Ghats, it is more likely that operation of several IWT vessels may enhancing the micro level of regional economics and impacts on the income of local populations.¹²



The river Ghats can be converted into the commercial spaces, local vending shops and regional markets may come up that helps to increase the several commercial activities.

IWT Incentivises the Ganga Ghats for selling of local produce by regional vendors.

(Fig No.100. Commercial activities along Varanasi Ghats, Source:)

The Interactions was conducted with the identified possible stakeholders along the Ganga Ghats at Varanasi including regional hinterlands of 10 Km UP- Stream and Down Stream from Raj Ghat Varanasi.

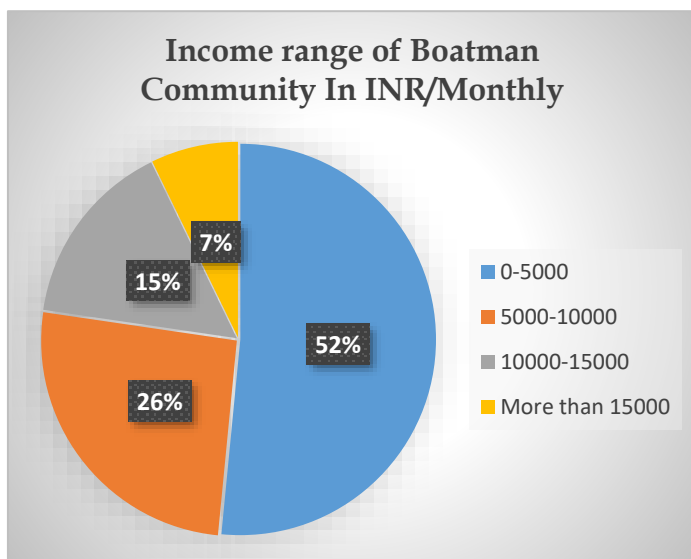
During the visit along the Ghats and interviewing the local public it was identified that ***Boatman and Fisherman community*** were living immediate to the banks of river.

Regional public movement noticed during crossing of river, the populations has reported that river transport may ease their life in many ways. The proposes IWT helps them to access Government and public facilities available at opposite Bank.

Following is the summary of findings for socio-economic survey conducted for fisherman and boatman community living along the Ganga hinterland, these population are major stakeholder and dependent on river Ganga, therefore the assessment of their socio-economic profile is essentially required, The random responses were collected from approximate from 150 persons during site survey in Varanasi region.

Survey has stressed to access socio-economic profile of the populations/stakeholder that heavily dependent upon the resources of Ganga River.

¹² Colombia University Report

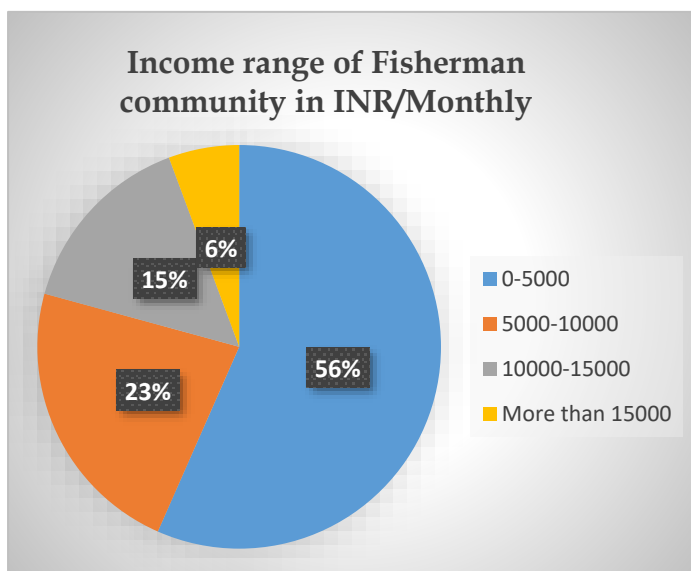


The livelihood of boatman community is heavily depended upon depend upon the water resources of river Ganga, boatman lives along the Ganga offers services of country boats for crossing the populations from one bank to another bank, the analysis of data reveals that more than 50% of boatman community income range is below INR 5000.

The possibilities of increasing the income of boatman community is possible by raising number of passenger ridership on their boats or the increasing traffic along water

routes may also increase their income. But as in current scenario's the IWT sector is under developed therefore the majority of public traffic diverted over roads and rail modes. Hence, the income level of boatman community is decreasing day by day. The development initiative of water transport services along Ganga hinterlands at Varanasi under Jal Marg Vikas Project has led for creating thousands of suitable infrastructures like passenger jetty or floating Jetty with all necessary amenities to ensure comfort passenger travel and offers reliable Inland Water Transport services.

Fisherman community is also depended upon the fish resources available in the river Ganga, this community lives immediate to the river side villages and heavily affected by the impact of Ganga water course. In socio-economic survey it was identified that this community is also affected very much due to the current river conditioning.



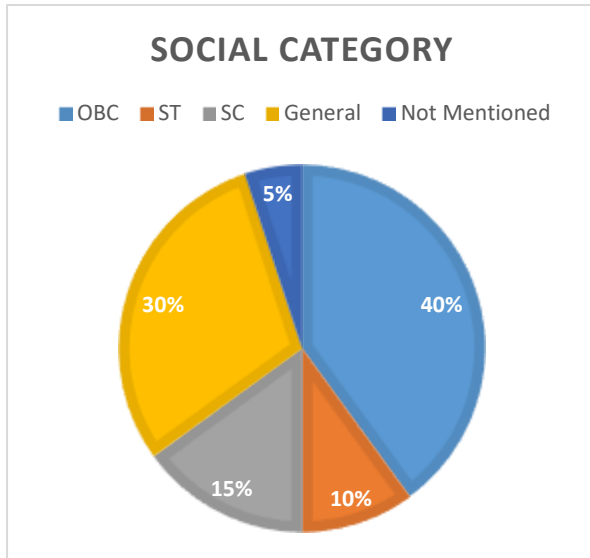
The bad river conditioning and deterioration of water quality, increase siltation in the river, that reduces depth in the river, therefore the fish catch of this populations are decreased. This population is also living under the venerable conditioning, majority of population's approx. 60% of them have income ranges below INR 5000 per month.

Inland Water Transport sector development also supports indirectly and directly to the fisherman community by taking river conservancy and river training works. The sufficient depth will be created

within the river channel and ensures for sufficient availability of water so that fish population will also be kept maintained.

The fish population maintenance and depth availability help fish in conceiving and number of fish populations likely to be increased, that may also help to boost the income levels of fisherman community.

Social category of populations involved in Fish Catching and Boat Rowing Activities:

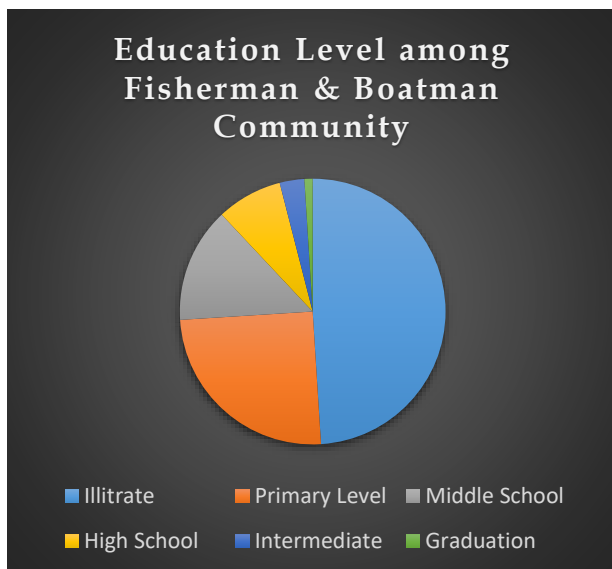


The Majority of populations under the fish catching and boat rowing activities are mainly under developed category, however the economic weaker sections of upper caste are also involved in this activities. the declaration given by the respondent has been taken for evaluations and analysis.

This indicator says that the almost every social category of the populations are depended upon the water resources of river Ganga

The development of Inland Water Transport offers several direct and indirect benefits to the populations living along the coastal hinterland of the river Ganges.

Educational Profile of boatman’s and fisherman’s living along the river Ganges



The education profile assessment survey provided the light of information that the populations performing the fishing and boating activity are majority of them illiterate or very poorly educated. Therefore, their dependence on exiting livelihood is more. This population can’t easily shift or migrate their economic acidity in other areas.

Hence, the development of Inland Water Transport Infrastructure may likely to absorb this populations in its operations along the river Ganges. And their traditional economic activity will also be get strengthened.

Overall the development prospects of Inland

Water Transport benefitted both fisherman and boatman community at large along the adobe of mata river Gange.

4.11 Inland Water Transport gives ride to the wave of regional economic development and nourished income for local population:

The water-based economy constantly moving towards the development of regions from old ages, the urbanization and economic development of Varanasi is largely dependent on the water resources available in Gangetic basin.

Inland Water Transport has touched the various aspects of re-development at Varanasi, the comprehensive study has interrelated IWT with context to the development of *Social Life, Land, Economics, Religion, Spirituals, Tourism, Trade Efficiency, Urban and Rural Pattern etc.*

Imagination of Water Transport at Varanasi led for exploration of advanced land and water centric development and alternative conception of transport infrastructure revitalizes the landscape of the region.

The majestic waterfront Ghats and steps lading down into the Ganga and crowd of millions of pilgrimages surprisingly moment on this earth. The Inland Water Transport may sharply leverage the opportunity for economic capture and help local population to develop economically.

People who lived around the Ghats and hinterlands of the river basin the generations of their families recognised about the benefits of Water Transport.

The IWT enable its stakeholders such as boatman, farmers, fisherman, visitors, brick makers to take advantage of river transport, the overwhelming increasing of crowd during occasions, festive months the demand of transport increases in Varanasi, to deal with such crunch the IWT will gear for handling the traffic surge.

Inland Water Transport triggers for carrying out various commercial activities along the Ganges Ghats, millions of pilgrims and tourist arrives here, so the increased economic activity directly benefits to the local public.

Varanasi region has diverse flora and fauna and native of different types of water and aerial species, the conservation measures taken during the Inland Water Transport development directly supports to them.

Inland Water Transport Infrastructure connects rituals with revitalizations of Waterways, the resident and community install the market, promote trade exchanges, manage the social and religious capital etc.

Inland Water Transport supports in performance of various regional and spiritual activities of different seasons at Varanasi, the study explored that IWT vessels may use during festivals of different seasons and public usages water rides and enjoy the leisure activities along the river Ganga.

Makar Sankranti, Shraavan Mas, Dev Deepawali etc are the major event where large number of public gathers along the Ghats of river Ganga and enjoy the rides.

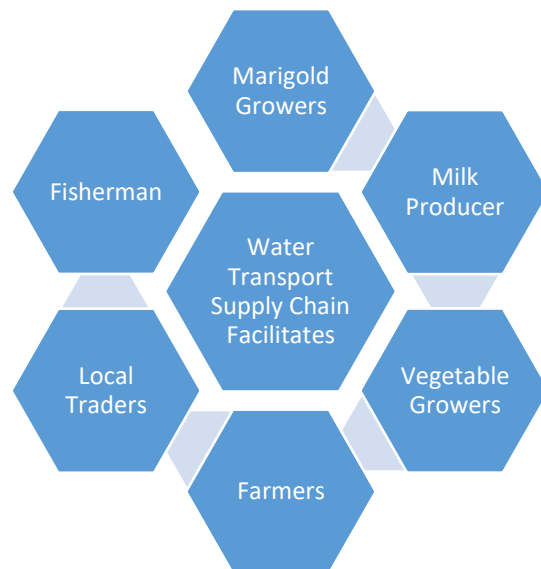
The Inland Water Transport facilitates large number of tourist, local public, commuters and pilgrims in witnessing Varanasi vibrant religious activities.



(Fig. No. 102. IWT Sector have positive Impact on various economic variable)

4.12 Inland Water Transport has economic impact on Regional Supply Chain of Local Produce: ¹³

The Varanasi region is the market place for various surroundings districts, the city infrastructure were also utilized by the populations living nearby of surroundings districts like. Chanaduali, Mirzpur, St.Ravidas Nagar, Sonbhadra, Ghazipur, Azamgarh, Jaunpur and Ballia etc. Therefore, vicinity of the city promotes interregional trades. Varanasi city appeared as significance for stakeholders requirements, as local public popularly visits to the city for varied purposes, however during survey the multiple interregional trade business and partnership associations noticed, the regional and rural areas of the Varanasi district have mainly production of agriculture inputs, small scale economic cluster, MSME units, local regional industries, large industries, SEZ etc. Hence the stakeholders selected Varanasi for marketing their produce. The city has huge population therefore the demand pressure exists and the stakeholders get maximum incentive by selling their produce in Varanasi region.



(Fig. No. 103)

¹³ The Asian Journal of Shipping and Logistics 33(4) (2017) 279-288, Article - The Logistics Performance effect in International trade, Authored by Azmat Gayani, Associate Professor, Sultan Qaboos University.

Inland Water Transport facilitate to the various rural populations or stakeholders in transportation of their goods to the city and also save from the middle man commissions.

Inland Water Transport available in far flung areas where roads and railways are not available and along both side of the river there is agrarian society, the IWT sector emerges dynamic transport options for farmers, marigold growers, vegetable growers, local traders, milk traders etc. for transporting their daily need goods through the routes of waterways.

4.12.1 MARIGOLD FLOWER

Marigold flower has a very important and prominent place on any occasion of celebration, either it's the welcome of some important person, the marriage ceremony, a festival celebration, a Puja of a deity or any function.

In Varanasi, marigold flowers are in demand around the year at the temple. The surrounding villages have cultivation of marigold and supply it to the wholesale market (Phool Mandi) in the city. The findings during field survey was that marigold cultivation were done in the various villages and Gramsabhas within periphery of 30 km form the main Varanasi city.

Major cultivation site of Marigold Flower at Varanasi Region:

Kaithi is popularly known as cultivation site of marigold flower along the bank of river Ganga basin at Varanasi stretch where the year around cultivation of marigold flower takes place, the marigold flower cultivation is popular among the small landholdings farmers of the region they grows marigold flower on their small agricultural field and the landless farmers cultivating marigold flowers on the Gramsabhas land located near the bank of river Ganga on NW-1.

The marketing and supply of marigold flower are mostly done with the help of middleman and brokers, they reaches to the cultivation sites and purchases marigold flowers directly from farm field in lowest price margin and supply it to the wholesale market on higher profit margin.

The Marigold farmers of the region are unable to harvest better profit margin from their marigold produce, at present the major incentives of produce were enjoyed by the middle man or intermediate traders.

Secondly..Rajatalab/Lohta/Chiragaon/Badgaon/Chaubeypur/Shivpur/Mirzamurad etc. are the local areas are the massive marigold flower cultivation site.

Wholesale Flowers Market at Varanasi, Uttar Pradesh

- Kisan Phool Mandi - Englishya Line Varanasi
- Bansphatak Phool Mandi Varanasi

Varanasi city is already having the presence of more than ten thousands temples where countless number of pilgrims were reaching to the city everyday hence there is year around demand generated for marigold flower for different reasons i.e Puja, Aarti, Marriage and any functions. The Kisan Phool Mandi & Bansphatak Phool Mandi are doing brisk business of flower in both retail and wholesale trades.

The Flower Traders from nearby districts such as Ghazipur, Jaunpur, Pratapgarh, and Allahabad reaches to the Varanasi Phool Mandi for bulk purchase of flowers buds and they supplies marigold in the respective regional markets.

During survey interview Shri. Vishal Dubey the owner of Kissan Phool Mandi, Englishiya Line have provided ground information that he manages for supply of marigold flower up to Patna, Kolkata, Delhi and Punjab cities as per the demand received from the respective markets, generally more supplies of marigold flowers are done in the local regional markets of Purvanchal region and presently the transportation of marigold flowers are manages with help of Mini/Small tempo trucks etc.



(Fig No.104.. View of Marigold flower cultivation along the Gramsabha's land on NW-1 hinterland)



(Fig No.104. View of Marigold flower Cultivation field at Kaithi, Varanasi, Uttar Pradesh)

Survey of Kissan Phool Mandi Varanasi

Kissan Phool Mandi is situated at Englishiya Line, Varanasi where bulk trades of marigold flowers takes place, the Marigold farmers, middleman, marigold traders from different Gramsabhas such as Kaithi, Rajatalab, Nagepur, Lohta, Dhamhapur, Veerbhanpur, Malkichak, Jhalhupur, Jamuwa Bazar, Mirzapur, Jaunpur, Chandauli, Bhadohi, Madhupur and Robertsganj etc. brought their marigold flowers produce to market it.

Cargo Type: Marigold flower

Average Monthly Supply:

Monthly approx. 70 mini trucks of marigold flower supplied to Kissan Phool Mandi form various parts of the Varanasi within the periphery of 30 Km surrounding areas.

The primary market survey assessment was that approximate daily 1-2 (Pickup & Mini Truck) of Marigold reaches Kissan Phool Mandi at Varanasi from Kaithi & Chaubeypur Gramsabha areas.

The demand of marigold flower may increase and decrease depending upon the seasonal requirements, mostly the demand of marigold flowers are at its peak during the festive months such as Sawn, Navratri and other festival

The overall observation was that marigold cultivation is in the trend at various Gramsabha of Varanasi district within the surroundings of 30 Kms, marigold farmers grows marigold flower on agricultural and Gramsabhas land and sell the produce to the middle man who collects marigold produce form various Gramsabhas farmers and supply it to the wholesale market by help of Mini trucks.

Origin Point: Kaithi/Chaubeypur/Mirzamurad/Lohta/Badgaon/Shivpur/Rajatalab and other local areas.

Regional Destination Point: Wholesale Flower Market at Varanasi

Final Destination and Trade Supply:

Patna/Kolkata/Delhi/Punjab/Ghazipur/Jaunpur/Pratapgarh

Logistics cost of Marigold Flower transportation:

The present logistics model followed for local transportation marigold flower met with help of Pickup/Mini trucks costing around of INR 1500/- to 2000/- per trip to the supplier/middle man for transporting flower from local cultivation site to Varanasi Phool Mandi.

Flowers are the perishable items hence for long distance transportation proper packing, refrigeration facility and dedicated fast transportation services are required to handover (flower) safely at destination point.

First Mile Distance: 4-5 Km Approx.

River Bank for Loading: Kaithi Ghat

River Bank for Unloading: Dashwamedh Ghat /Rajghat Varanasi

Last Mile Distance: Approximate 3-4 Km up to Kissan Phool Mandi.

Additional Information: on average 3-4 trucks of marigold flower supplied weekly to Kolkata and Patna form Phool Mandi Varanasi and some other imported flowers comes from Kolkata to Varanasi every week.



(Fig No. 105 View of Wholesale flower Market (Kissan Phoo Mandi) at Varanasi)

4.12.2 Case Study: Analysis of Cost Incurred on Marigold Flower from Kaithi to Kisaan Phool Mandi

Cost Centre	Road Transportation from Kaithi Hinterland to Kissan Phool Mandi for 600 Kg	Waterways Transportation Cost from Kaithi Hinterland to Kissan Phool Mandi for 900 Kg
<i>Assumption: The Maximum Qty. can be loaded on Mini truck is only up to 600 Kg and IWT has advantage of loading up to 1 tons of Cargo on presently available country/local boats. However the demand and Qty. of cargo is dynamic, the assumption is consider by estimating current market profile.</i>		
Road distance from Kaithi to Kissan Phool Mandi, Englishya Line, Varanasi	40 KM	
IWT route distance from Kaithi to Raj Ghat/Khirkiya Ghat.		35 KM
Estimated First Mile Cost for 4 Km approx. (Applicable for IWT)		300
Loading cost per mini truck approx. (INR)	200	200
Freight cost per mini truck approx. (INR) through Roadways	1500	
IWT Freight Cost		120
Unloading & Loading cost at the Rajghat/Khirkiya Ghat Varanasi (Approximate) for cargo equivalent to mini truck (Applicable for IWT Route)		350
Last Mile Transportation cost for 4 km approx. from Raj Ghat to Phool Mandi. (Applicable for IWT Route)		300
Unloading cost approx. (INR) at Phool Mandi	200	150
Total	1900	1420
Economic Cost Savings by Using IWT Mode in INR 480/- per trip and IWT transports 300 Kg More as compared to the Roadways.		

(Table No.18 : Supply Chain & Cost Analysis for Marigold Flower Transportation)

4.12.3 Assessment of Cargo Market Potential for Marigold Flower:

Demand of Marigold flower is very high in the Varanasi city as itself as there are large number of temples where huge amount of flowers are used for performing various types of rituals and hotels where flower are used for decoration and to lure foreign tourist.

Varanasi is an important centre for various religions namely Buddhism, Jainism, Hinduism and Islam and all the festivals of corresponding religion are celebrated whole heartedly due to which during peak festive season the sale of flowers amount in lakhs

National Highway 2 and National Waterways -1 may provide good linkages for transport of Marigold flower produce from cultivation site to Market Place.

Existing Wholesale market is available such as Bansphatak Mandi and Kissan Phool Mandi at Englishiya Line.

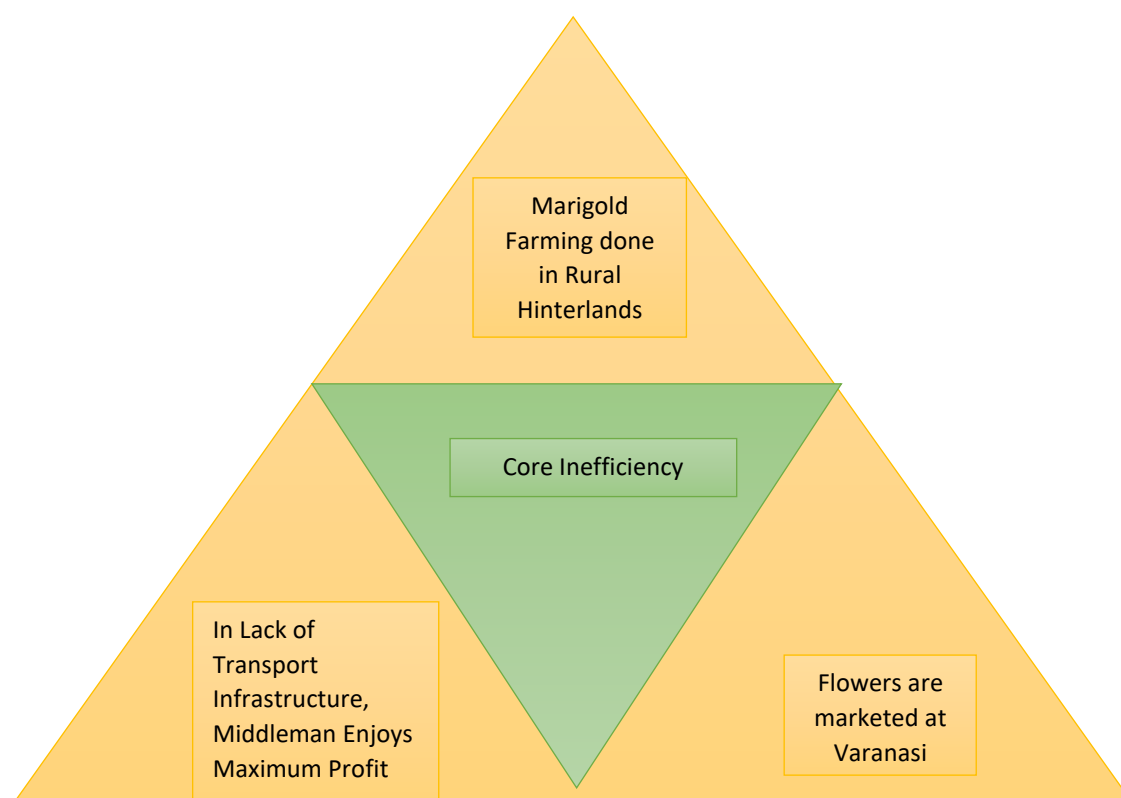
The Incentive from growing marigold flower is very high as compared with any other traditional crops.

During the peak business festive seasons like *Navratri, Sawan, Budh Purnima, Ramleela, Dhrupad Meela, Hanuman Jayanti, Bharat Milap, Nakkataya, Nag Nathaiya, Mahashivratri, PanchKoshi Parikrama and Ganaga Mahotsav* and any other occasions where revenue of marigold flower and garland touches the business of 2-3 lakhs per day. Genda (Marigold), Madar and Rose are mainly sold in the wholesale markets at Varanasi

The sound marketing and transportation facilities are important for the economic development of the targeted community of marigold growers, the farmers of the region prefers to sell their produce directly without interface of middle man but due to lacks in the transportation facility and scale of margin is very low hence they have to sell it to the middle man.

Second constraint was the fluctuated price of marigold because its seasonal demand hence the farmers are not much aware about the right market price, the most of the market profits are enjoyed by the middle man traders.

4.12.5 CORE INEFFICIENCY IN PRESENT VALUE SUPPLY CHAIN OF MARIGOLD FLOWER



(Figure No.106. Core Inefficiency in Local Supply Chain of Marigold Flower)

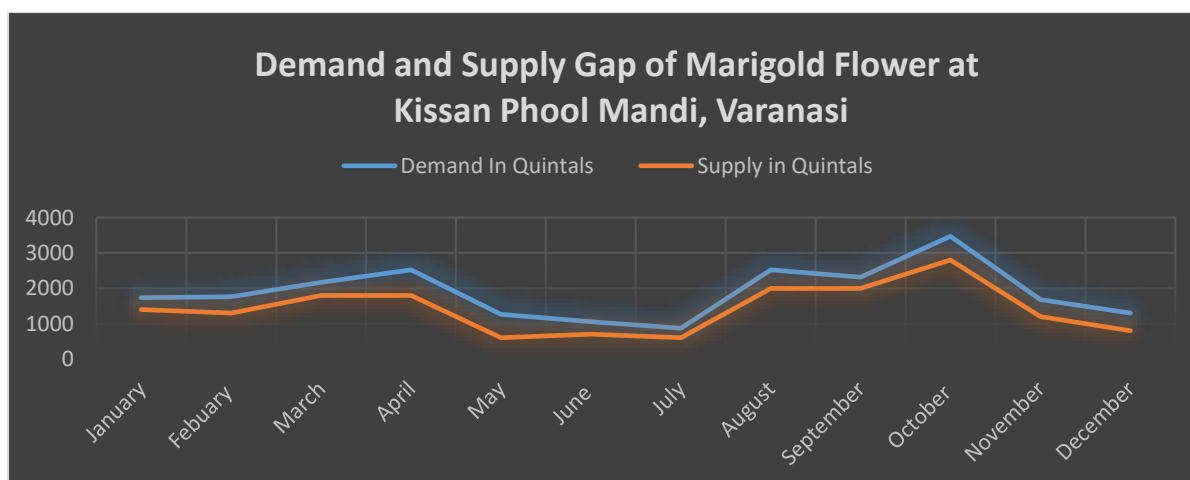
Annual Demand and Supply Gap

- Due to unorganised transport facility the local farmers are unable supply marigold to the Phool Mandi
- Middle Man is acting as key player for trading of Marigold and most of the profits are enjoyed by them. Hence lack of transport infrastructure Marigold Growers are unable to make profit.
- Marigold cultivation are majorly done by the small & marginal scale land holdings farmers.
- Marginal quantity output of marigold flower for individual farmers for transportation cost is low, hence individual farmer is not getting viability.
- Due to unorganised transport facility the local farmers are unable supply marigold to the Phool Mandi

Estimation for Marigold Flower at Kiassan Phool Mandi:

The data for demand estimation was collected every week over telephonic interactions with owner of Kissan Phool Mandi over the period of one years, Sh. Vikas Dubey ji has supported by providing average daily data of trucks landing at Kissan Phool Mandi, Englishiya Line therefore it was possible to prepare demand assessment of marigold flower for all months.

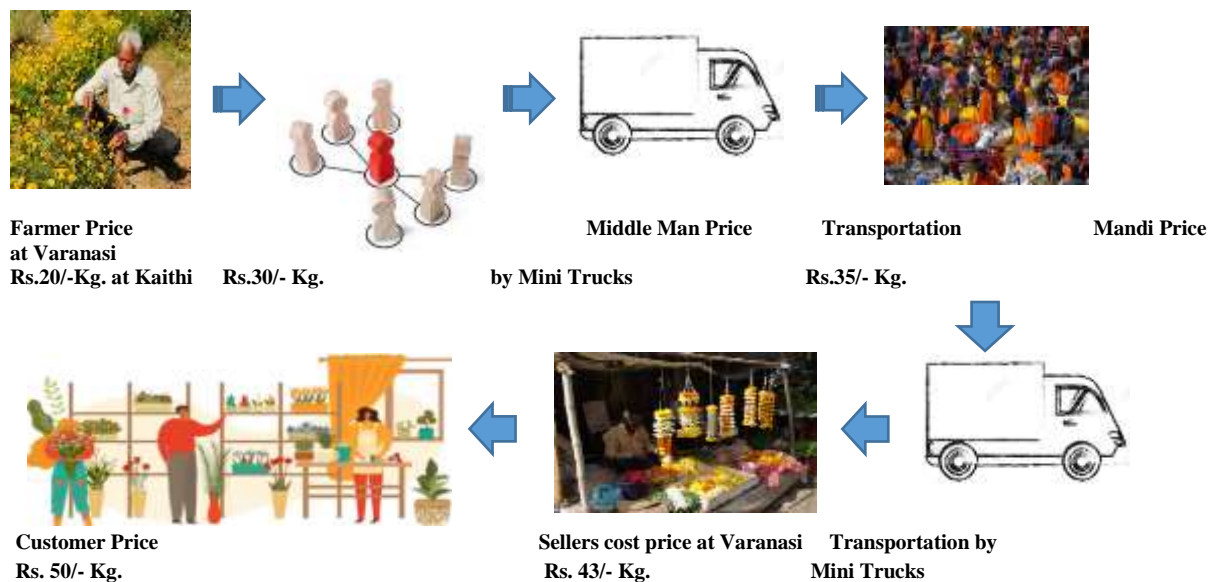
As during the primary interactions it was indicted that demand of Marigold is throughout the year but certain times demand of marigold flower is touches spikes during festival months especially at the time of Navratrs (Chait and Poosh Maas) and also demand of flower is high during Sawan month, Ganga Dussehera and Dev Deepawali. Etc.



(Fig: No. 107 Month wise estimated demand and Supply Gap for Marigold Flower at Kisssan Phool Mandi, Varanasi)

The Information available on demand and supply of Marigold Flower is clearly indicates that demand of flower is always at higher but Market supply side is not even meet up in any of the month, it is clear indicted that there is Gap in Demand and Supply of Marigold Flower in Mandi. However the interactions with Marigold Growers we came to know that most of the flower of their get damaged due to lack of appropriate refrigerated transport facility, and pilferages ratios are very high with road transport.

Current Value Chain of Marigold Flower where Middle Mans are Involved in Trade and Transported of Marigold Flower from Kaithi to Kisaan Phool Mandi Varanasi



The present trades and transport of marigold flower, the involvement of various marketing intermediaries exist, Middleman are involved, they play as pivotal role in collecting marigold flowers from farmers and supply it to the Kissan Phool Mandi at Varanasi.

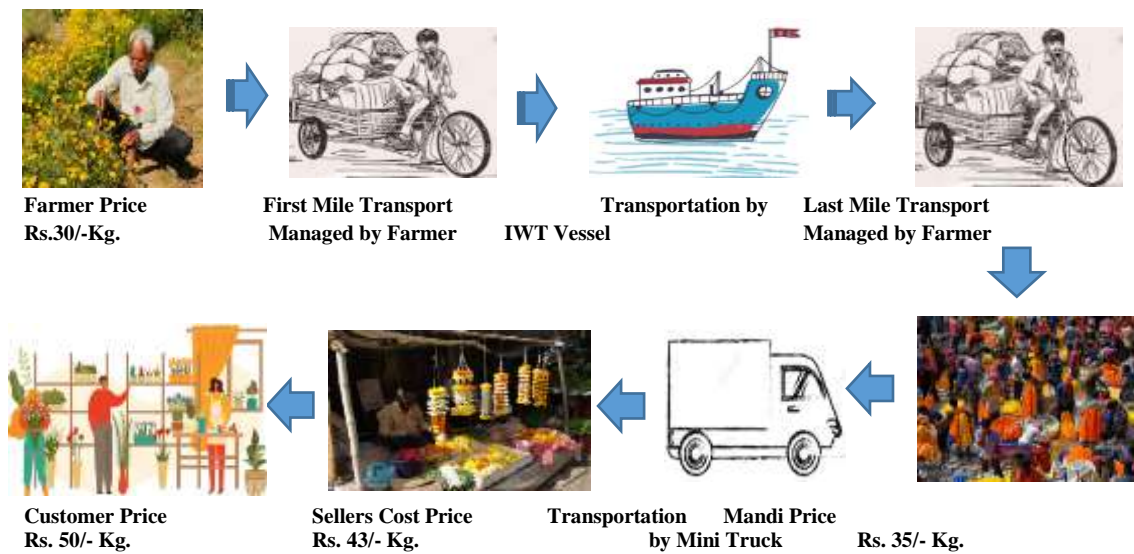
The Marigold Farmer gets only INR 20/- kg the middle man sell it to the Mandi at INR 30/- Kg. with keeping margin of 33% , further Market Intermediaries at Phool Mandi sells Marigold at INR 35/-Kg. with keeping their margin of 15% and further regional sellers involved in the flowers business they purchase flowers from Mandi and manage transport cost hence their total purchase cost will become Rs.43/- Kg. and thereafter they sell it in market to customer at Rs. 50/-Kg. with keeping profit margin of 14%

The overall gap in farmer price and market price is Rs.30/-Kg. which is 60% of margin that are enjoyed by various market intermediaries and middle in trades and transport of flowers.

Marigold growers are not having the sufficient knowledge and transport facility options or not having economic qty. of flowers so they can't make their produce reach to the market by them, hence they depend upon middleman's to sell their Marigold Flowers.

In present Value chain the Marigold growers at Varanasi region is losing their profitability and the middleman is enjoying maximum profit margin

Future Value Chain with Inland Waterways Transport (Case-1)



The Inland Water Transport may offers transport choice to the Marigold Growers in making their produce transported by themselves with help of IWT vessels.

The Marigold Grower can use Rickshaw or Tricycle or Bicycle for first mile transport up to the Community Jetty that proposed to be developed along the banks of river Ganga near to the potential Gramsabhas.

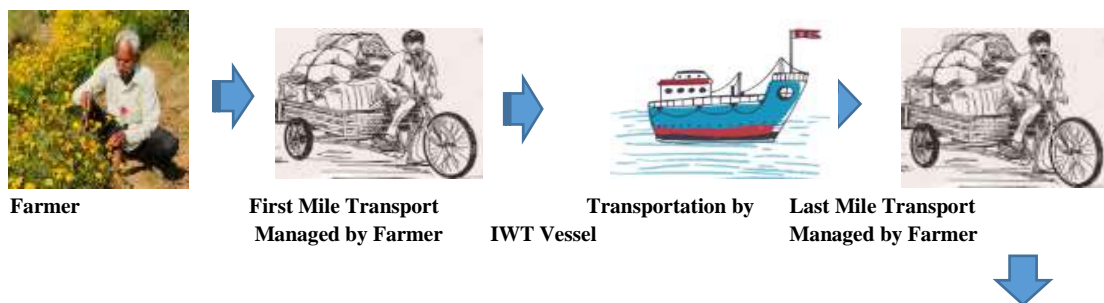
Thereafter with help of Water Transport the Marigold grower transport their cargo up to main city i.e Ganga Ghats which is nearer to the Kissan Phool Mandi.

The farmers can manage last mile transport with tricycle and himself they sell marigold in Kissan Phool Mandi by avoiding middle man commissions.

The proposed IWT Sector at Varanasi supports farmers of the region in increasing their Income and increase rate of their produce

The proposed IWT routes helps Marigold growers in earning the trade margin of approx. 50% compare to previous rates where they get Rs.20/kg of the produce, Now with help of IWT transport they can earn rate up to Rs.30/- Kg of their produce. Which is 50% times higher rate. However transport cost are managed with IWT will be bearded by the farmer.

Future Value Chain with Inland Waterways Transport (Case-2)



(Fig .No. 108)



Similarly, As stated in Case 1 where farmer supply marigold directly to the Kissan Phool Mandi with help of IWT routes, Now if farmer avoids Mandi and directly sells their produce by vending on streets in the Varanasi city they have more possibilities of earning profit by selling Marigold.

As, in present set Farmers only get Rs 20/- Per kg of their Marigold Produce, when Farmers usages IWT Vessel for Transportation of flowers from Kaithi to Varanasi and thereafter they manages to sell their produce by vending on streets at Varanasi city, along the Ganga Ghats, near to the vicinity of temples they have possibilities of earning maximum profit.

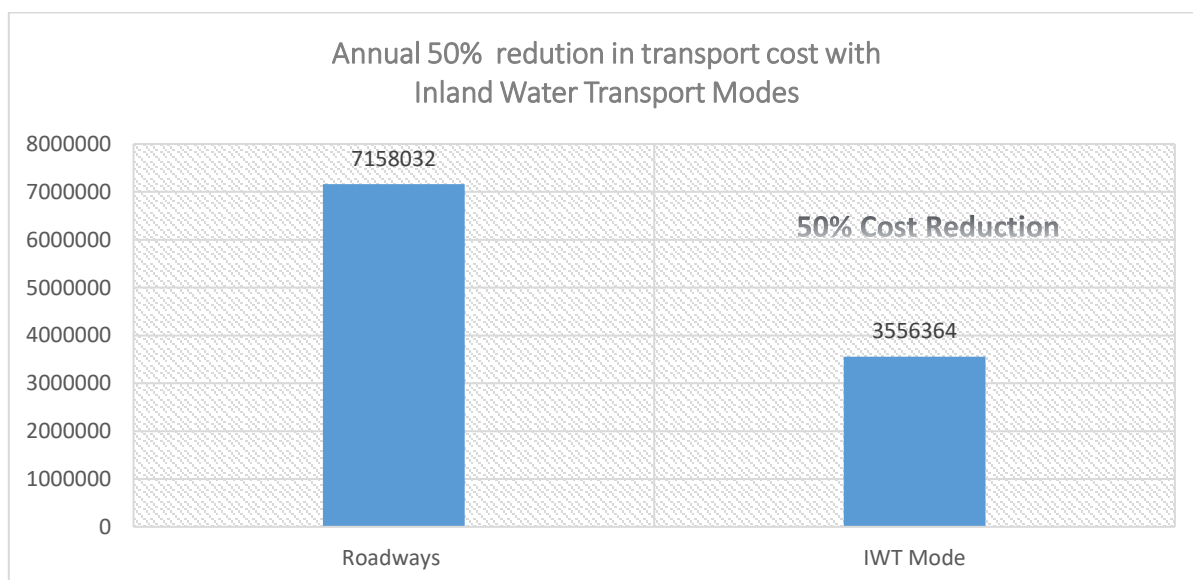
This case 2 model best suited to the Marigold Growers of the region as they are having small landholdings hence the economic quantity were not achieved by them to sell at Mandi level, With support of Inland Water Transport the Marigold growers can earn maximum profit.

In this way the farmer can earn the trade margin of approximate 150% where they have to manage the cost of IWT transport and Selling of flower activity is also performed by them.

Marigold Growers have huge economic impact of IWT sector development at Varanasi region, as these farmers are living close to the vicinity of river Ganga hinterland. IWT sector transport supports them in managing their produce to bring at right market place where they earn maximum profit margins.

4.12.6 Assessment of total annual cost Incurred on Transportation of Marigold flower in Varanasi region.

(Assumptions: The total cargo quantity traded has been taken reference from Kissan Phool Mandi and transportation cost is calculated separately for roadways and Waterways cases.)



(Fig.No. 109 Analysis of Annual Cost Incurred on Transportation of Marigold Flower from Kaithi to Varanasi with different modes of Transport)

The detailed analysis were also done for the cargo quantity supplied and traded at Kissan Phool Mandi, Englishiya Line, and Varanasi. Sh. Vikas Dubey owner of the Kissan Phool Mandi has provided annual details of cargo Quantity Trades at Mandi, therefore it was possible to estimate

total approximate cost incurred on transportation of Marigold flower annually in Varanasi region, The annual cost of transport is INR 71, 58,032 whereas if it was re-routed with IWT then annual cost for transportation of same quantity will be INR 35, 56,364/-

The estimation of transportation cost for Roadways and Waterways has been already done in table previously, the same cost was extrapolated used in identifying annual regional cost incurred on transportation of Marigold Flower.

Approximately, the IWT cost is 50% lesser than roadways cost.

4.12.7 IWT Advantages and its economic Impact on Marigold Growers at Varanasi Region:

- IWT offers seamless Transportation options nearer to the farmland of Marigold
- The cost of Transport with IWT mode is cheaper and Farmer himself carry can goods to the city for selling their produce
- IWT supports farmers in avoid in middleman commissions during trading of marigold flower.
- IWT reduces carbon footprint and help in reduction of traffic congestion in the already congested city like Varanasi
- Farmer can use IWT mode for Transport and himself earn maximum possible profit. IWT supports in Increasing their Income.
- The pilferages with IWT mode is also controlled up to maximum extent.



(Fig.110. Local Population Travelling in Country Boat to reach Varanasi from Kaithi)

4.12.8 VEGETABLE GROWERS:

Vegetable are essentials requirements for every household, demand for vegetable is always higher year around, hinterland survey findings was that many small – scale and landless farmer’s uses land along the river bank for cultivation of vegetables. Darira was a traditional practices of the farmers and they were continuing the cultivation and expanded their market by supplying vegetables to the wholesale Mandi at Varanasi and Ghazipur

Mainly watermelons, cucumbers, bottle-gourd and muskmelon are cultivated along the bank of Ganga and marketed in the various wholesale Mandi at Varanasi and nearby regions.

Majority of farmers at Varanasi and Ghazipur mostly they are small and Marginal landholdings, so vegetable production with improved agricultural technology suites them, as it offers high market values and productivity rather than any other crops, IWT can help those farmers who lives in the villages which are nearer to the bank of Ganga along NW - 1, with IWT they can easily carry their vegetable to the markets and they may get the best incentives of their produce.

Cultivation Site:

- Villages nearby to bank of river Ganga – Produces variety of local vegetables
- Almost every Gram Sabha having horticulture activities few example are Raja Talab, Mirzamurad, Kaithi, Chaubeypur, Chunar, Chaundauli and Saidpur, Aurihar and many more in Ghazipur & Varanasi

Wholesale Vegetable Market in Varanasi:

- Visheshwar Ganj Sabzi Mandi
- Pahariya Sabzi Mandi
- Chanduwa Satti Sabzi Mandi
- Rajatalab Sabzi Mandi

Wholesale Vegetable Market in Ghazipur District:

- Saidpur Sabzi Mandi
- Ghazipur Sabzi Mandi

Various types of Fruits & Vegetables were popularly grown at various Gramsabhas along the Ganga and supplied to the wholesale market with help of middle man.

Varanasi & Ghazipur regions having high production of Tomato, Potato, Red Chilly, Brinjal, Peas, Sponge Gourd, Bitter Gourd, Bhendi, Cabbage, Cauliflower Onion, Mango, Guava, Aonla, Banana and Litchi etc.



(Fig No. 111 View of Vegetable cultivation Sites near Bank of Ganga & Gramsabhas)

4.12.9 Assessment of river Ganga hinterland – Saidpur

Saidpur is a town and a Nagar Panchayat at Ghazipur, the nearest railway station is Aunrihar Jn. main hub for travelling, business, and education and public offices.

Saidpur is important hinterland along the bank of Ganga at Ghazipur. Inland Waterways Transport may have many opportunities in shifting the economic gears of this region. At present Saidpur is established as town and its local market caters verity of public needs time to time.

Saidpur Ghat is just 500 meters away from its main market location, during interaction with local publics & businessmen of the area, they clearly indicated there is frequent movement varieties of cargos in between Varanasi and Ghazipur.

Siadpur has wholesale markets of vegetables, Milk & Khowa , Potteries & Clay utensils, clusters of agricultural equipment's manufacturers etc.

Survey of Saidpur Vegetable Wholesale Market

Cargo Type: Vegetable & Fruits

Average Monthly Supply: After interviewing the local public and vegetable sellers we come to know that approximate 30 trucks of vegetable supplied on daily basis form Varanasi to Saidpur and Aurihar vice versa

Origin Point of Cargo: Vegetable usually cultivated nearby Gramsabhas along the banks of Ganges at Ghazipur & Varanasi region hence there is year around vegetable cargo available for supply

Varanasi vegetable mundi having bigger scaled capacity in the region hence maximum supply was done through Varanasi Wholesale Market.

Destination Point: vegetable of Varanasi wholesale market were supplied to the entire Purvanchal Region by trucks

Present Mode of Transportation: Vegetables were carried by Mini trucks/tempo etc.

Present transportation cost: During survey it was noticed that small truck i.e. Pickup/Tempos were used for carrying vegetables up to the mundis form various Gramsabhas and bigger trucks were used for long distance transportation. Approximate cost of 20 Km transportation was in between Rs 1500/- Rs 2500/- Per trip by small trucks.

Nearest River Bank: Siadpur Ghat is located around 500 metres form this Mundi in Ghazipur

Scope for IWT: Vegetables & local fruits can be transported through IWT along its hinterlands and IWT facilitate farmers in marketing of their agricultural produce, however IWT can provides its significant contribution in improving agricultural economy of the entire region.

4.12.10 IWT Market Survey & Stakeholder Assessment at river Ganga Hinterland, Saidpur

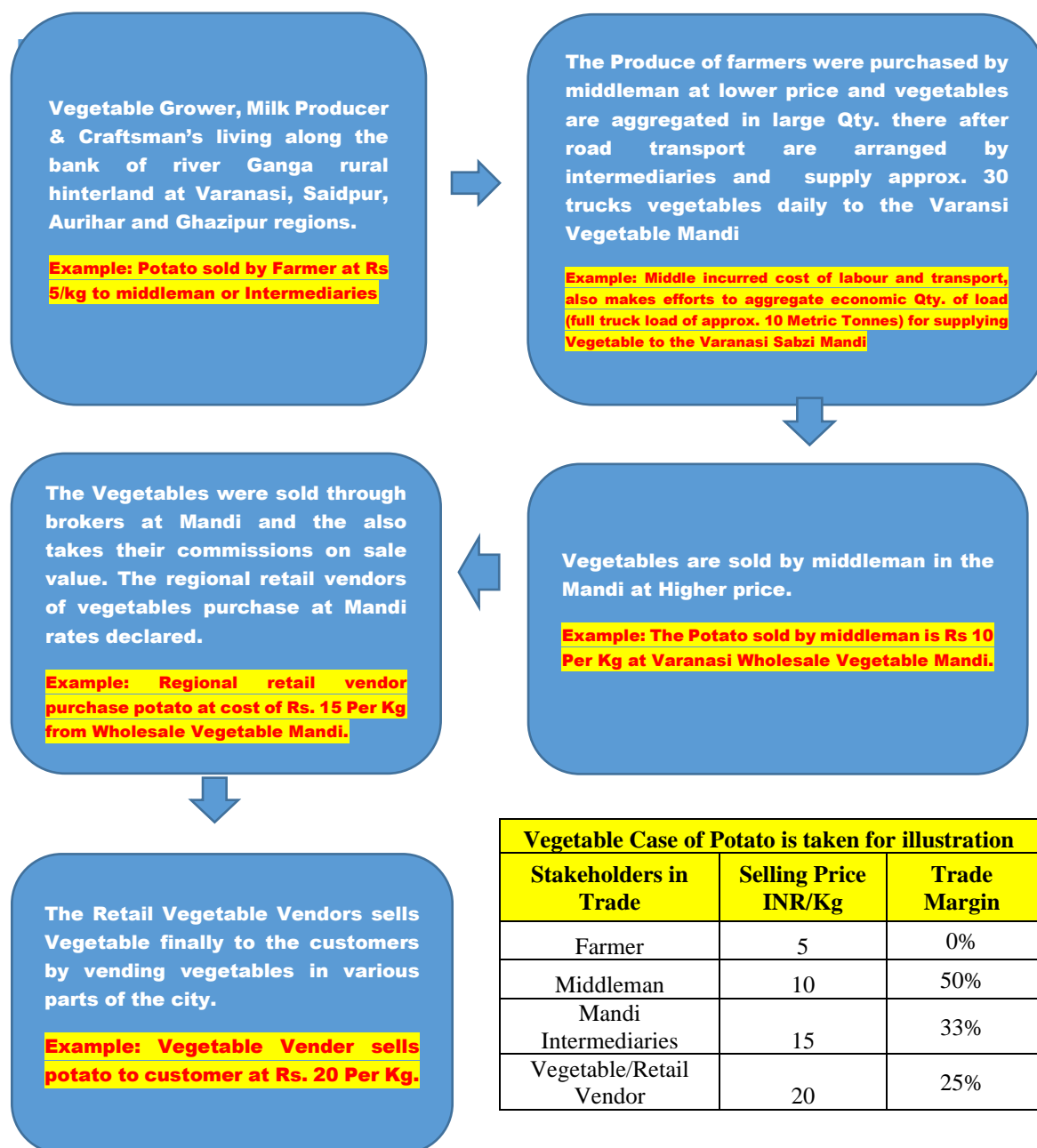
Prospective IWT Stakeholders on NW-1 Hinterland	Vegetable Wholesale Market	Milk – Khowa – Paneer Mandi	Pottery & Clay based Utensils
Cargo Type	Vegetable	Milk Made khowa & Paneer	Pottery
Average Monthly Supply	Approximate 900 Mini truck monthly supply vegetables from Saidpur to Varanasi and vice versa.	Approximate 600 Quintal of Khowa supplied to Varanasi every month	Approximate 30 Mini truck monthly supply to Varanasi by the businessmen
Origin Point of Cargo	Saidpur/Varanasi	Saidpur Mandi	Saidpur
Destination Point	Varanasi /Saidpur	Varanasi & Ghazipur,	Varanasi
Present Transportation Model	Roadways (Mini truck)	Farmers carry their produce by roadways through (Bus/Temp/Mini Truck)	Roadways (Mini Truck)
Cost of transportation	For mini truck 2500 – 3500 per trip charged form Saidpur to Varanasi various destinations	For Mini Truck 2500 – 3500 Per trip charged form khowa mandi Saidpur to Varanasi	For mini truck 2500 to 3500 per trip form Saidpur to Varanasi
Nearest River Bank	Saidpur Ghat / Rang Mahal Ghat	Saidpur Ghat / Bade Mahadeo Ghat 800 mtr form Khowa Mandi	Saidpur Ghat
Scope for IWT Sector	Improved IWT infrastructure will offers public to carry vegetables, grains and other goods	Every day khowa supplied to the Varanasi and Ghazipur form this place IWT can attract this cargo along with other cargos on same voyage and drop at Rajghat in Varanasi	Usage for Potteries and clay based utensils are very high in the Varanasi Region (Drinking of Tea in Chukad is common) all these materials were produced by potters in the various hinterland of Ganga, IWT can help for transportation of these potteries to the urban market

(Table No.19 Focus Group Discussion Assessment of present cargo that may shifted on IWT mode)

4.12.11 Present Supply Chain of Vegetables Trade & Transport arrangements at Varanasi

Vegetable are grown in very large quantity along the hinterland of river Ganga, and most of produce are demanded and consumed at Varanasi city, In present supply chain arrangement middlemen procures and aggregates vegetable cargo directly from farmers in lower price.

The involved marketing intermediaries enjoys most of the profits as they purchase vegetables in lower price and sell it at Varanasi Vegetable Mandi at higher price. Therefore in current supply chain and trade arrangement most of the profit margins are enjoyed by middleman instead of farmers.



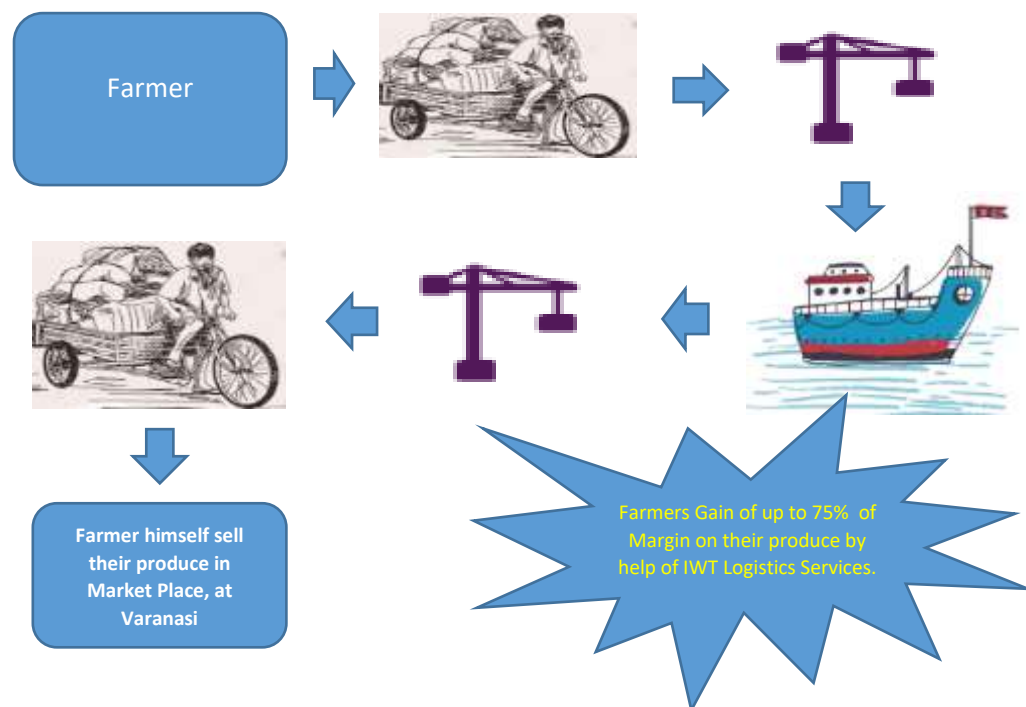
(Fig No. 112)

4.12.12 Supply Chain Arrangements with Inland Water Transport Services and its Economic Impact on Vegetable Growers at Varanasi Region:

Regional farmers/vegetable growers living along the banks of river Ganga manages transportation of their Vegetable produce through IWT route, the regional farmer's usages community jetty IWT for aggregation of their vegetable produce and by help of vessels/boat they can easily transport their Vegetable to the Market place at Varanasi on daily basis.

Using IWT mode will help farmers to eliminate the middleman and other marketing intermediary's commissions. If farmers himself market their produce in the market this enables them in earning more economic profit.

The IWT helps farmers in earning of extra cumulative margin on illustrative case of Potato is maximum of 75% of margin on their produce. Previously that was enjoyed by middleman. The intermediary's commissions will be removed by IWT logistics supports, the farmers of the region being enable themselves to transport their produce directly to the marketplace and sell himself to get maximum benefits up to 75% of trade margin on their vegetable produce.



(Fig. No.113. Proposed IWT Logistics arrangements for regional vegetable growers at Varanasi region.)

4.12.13 Assessment of Transportation cost with different modes of Transports:

The illustrative case of potato has been considered in survey of vegetables, the data collected from Mandi, Middleman and Farmers on cost incurred on transportation from Saidpur to Varanasi. Accordingly the data available it was analysed further to calculate per/kg approximate transportation cost may incurred with different modes of transport. As below table clearly indicates that IWT modes saves approximate 26% of transportation cost savings per kg on vegetables from Saidpur to Varanasi hinterland. It is clear indicator that the IWT sector has huge economic cost savings on transportation, secondly it avoids middleman commission by enabling farmer access to the city, third Farmers can earn maximum trade margin by eliminating the intermediary's commission, fourth reduction in traffic congestion of the region, fifth IWT reduces carbon foot prints etc.

Illustrative case of Potato for cost assessment of vegetable transportation from Saidpur to Varanasi by using different transport modes (Distance approx. 20km)		
Parameters	Roadways (INR/Kg)	IWT (INR/Kg)
<i>Loading Cost</i>	0.25	0.25
<i>First Mile</i>	NIL	<i>Manage by Farmer through Tricycle</i>
<i>Transportation Cost</i>	2	1.33
<i>Unloading cost</i>	0.25	0.25
<i>Last Mile</i>	NIL	<i>Manage by Farmer through Tricycle</i>
<i>Total Cost</i>	2.5	1.83
<i>Per kilogram transportation economic cost savings with IWT mode compared to Roadways</i>		26%
<i>Source: Survey data and analysis</i>		

(Table No. 20)



(Fig. No.114. View of Sabzi Mandi Saidpur Ghazipur Uttar Pradesh)



(Fig. No115. View of Vegetable Wholesale Market Saidpur Ghazipur)

4.12.14 Economic perspectives of developing Inland Water Transport for Farmers benefiting along river Ganga hinterland.

Presently farmers of Saidpur and Varanasi area are taking help of middlemen and roadways mode of transportation for carrying their Vegetables to Varanasi, annually approximately 10800 mini trucks were deployed for transporting Vegetable from Saidpur to Varanasi.

Each mini truck carries approximately 1000 Kg of loads therefore the total lead distance (up and down) of approximately 60 Km truck travels, therefore, annually total approximately 6.5 Lac kilometres these trucks runs for transporting only Vegetables from Saidpur to Varanasi.

This is one of case that studied to illustrate the economic benefits of developing the IWT Sector at Varanasi region.

Transportation sector benefits are very dynamic in nature, the economic benefits largely depending upon the Time Cost and Money factor variable. Therefore, in vegetable case Time cost and money factors best suited to farmers, hence vegetable cargo traffic may re-routed through IWT routes in Varanasi region to reap several economic benefits.

Estimation of total truck annual used to transport vegetable From Saidpur to Varanasi region

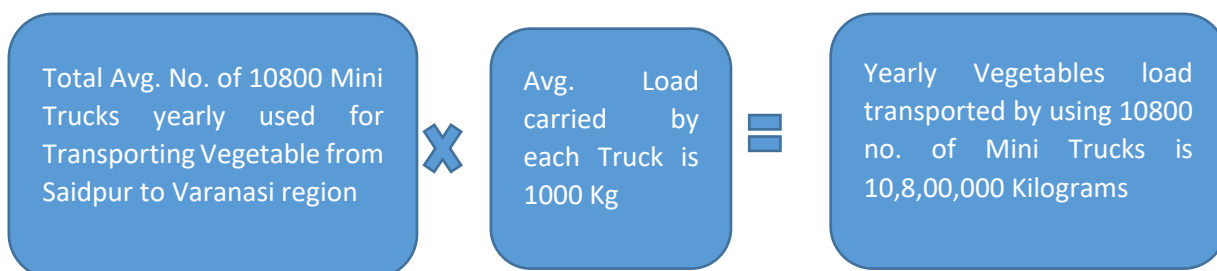


In primary survey monthly data of truck movements was collected by interviewing Vegetable Mandi stakeholders i.e Works/staffs working in Mandi, Sellers and buyers, Local Truck Drivers, Transporters, and Mandi Owners and Contractors. They have provided the details of

challan slips from there the average total monthly trucks details are collected and based on available data the annual average numbers of trucks has been calculated.

Estimation of total Vegetable loads transported from Saidpur to Varanasi Region:

The standard payload of mini truck is 700 Kg standard, however the local transported manages to transport 1000 Kg of load per mini truck to gain more economic benefits and earn maximum incentives as possible.

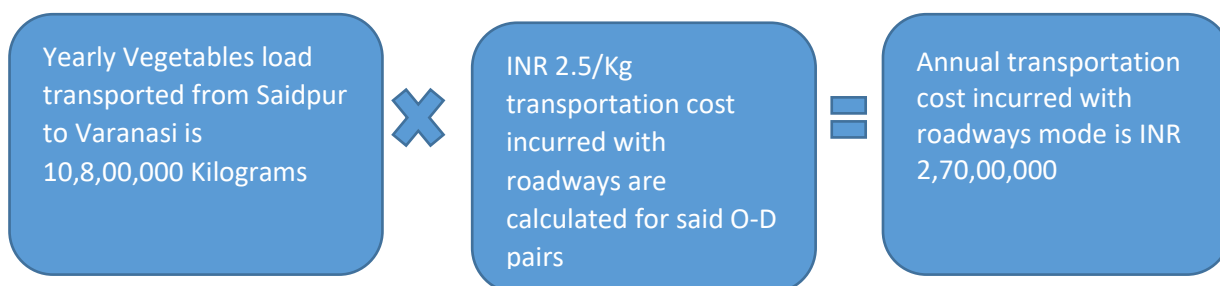


The total no of trucks was identified in primary investigations and average payload carried by each truck is confirmed by truck drivers and transporters. Therefore, we able to get cumulative annual load of vegetable transported from Saidpur to Varanasi region.

We have identified annually 10,8,00,000 kilograms of vegetable are only transported from Saidpur area to Varanasi by using total 10800 trucks.

Estimation of annual cost incurred on transporting vegetable from Saidpur to Varanasi through transportation mode of roadways.

As we have already estimated the cost incurred on transporting per kilogram of vegetable from Saidpur to Varanasi region by different modes i.e Roadways and IWT modes. (Please refer previous table)

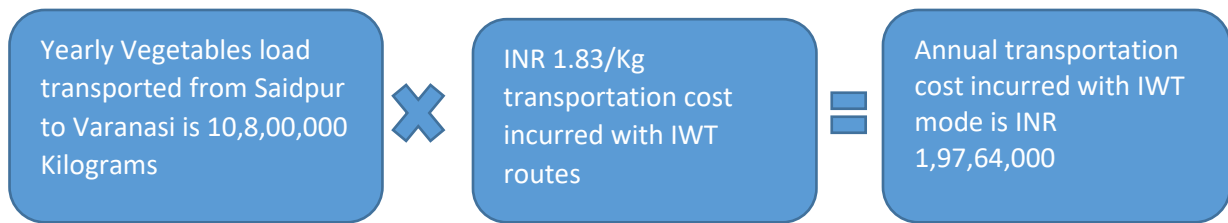


The Per/kilogram transport cost with roadways is already calculated in previous table, therefore by multiplying annual quantity with per/kg transport cost we easily estimate the total annual estimated expenditure incurred on transportation cost i.e INR 2,70,00,000/-

Estimation of annual cost incurred on transporting vegetable from Saidpur to Varanasi through transportation mode of Inland Water Transportation Mode:

Similarly, as like roadways we have estimated transportation cost per/kg of IWT routes in our previous table i.e INR 1.83/kg are found when farmers select IWT mode to transport their vegetable.

Therefore, we can identify annual cost incurred on vegetable transportation from Saidpur to Varanasi of quantity volume estimated.

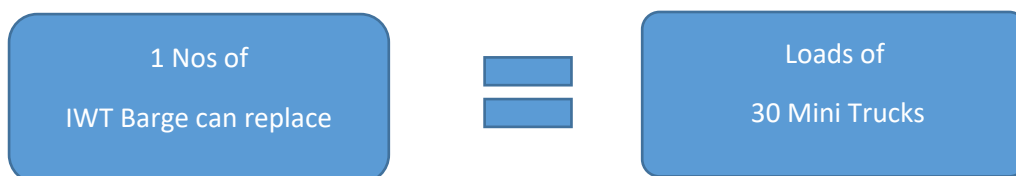


Estimation of yearly kilometres of transportation leads incurred selecting different modes of transportation by the farmers of Saidpur-Varanasi.

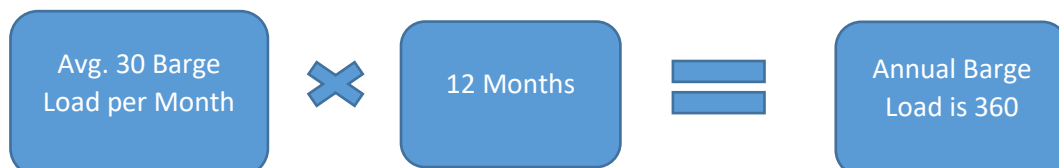
The one side up and down the distance of approximately 60 kilometres are travelled by the truck therefore, the total transport distance of annual lead is calculated easily by following method



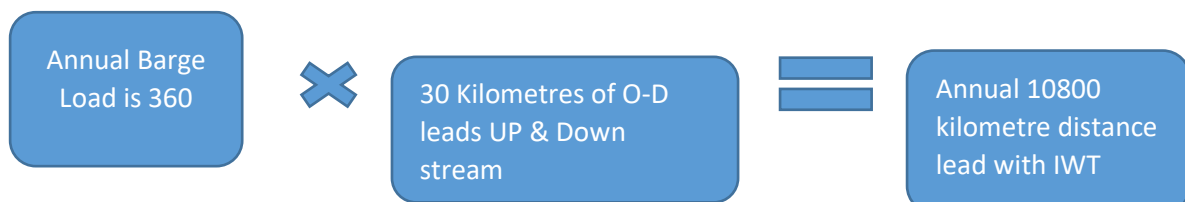
Similarly, with IWT O-D pairs identified distance is identified from Saidpur Ghat to RajGhat Varanasi is 15 Km one side, In IWT case the deployment of one barge is sufficient to transport the daily cargo that carried by Avg. 30 Mini trucks daily, hence with IWT one trip daily is sufficient, hence the IWT routes saves the kilometre runs also for transporting same volume of cargo that was done by the mini trucks with roadways.



Therefore only 1 barge transport load economics is sufficient in replacing traffic of 30 mini trucks from roadways and it may also give huge savings of annual transport leads in kilometres for carrying same cargo quantity.

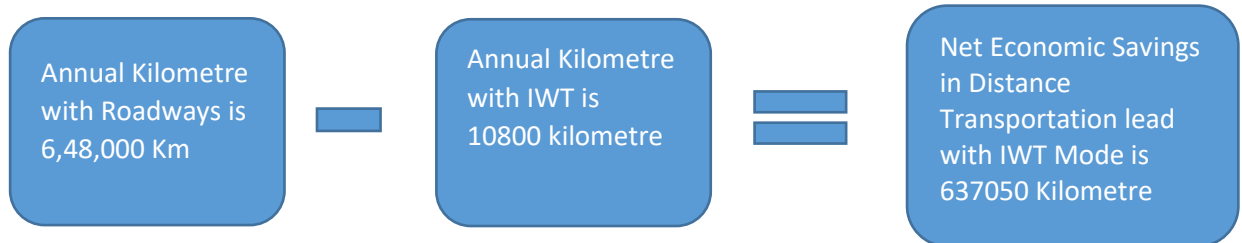


Therefore, the total distance lead in kilometres with IWT routes are estimated

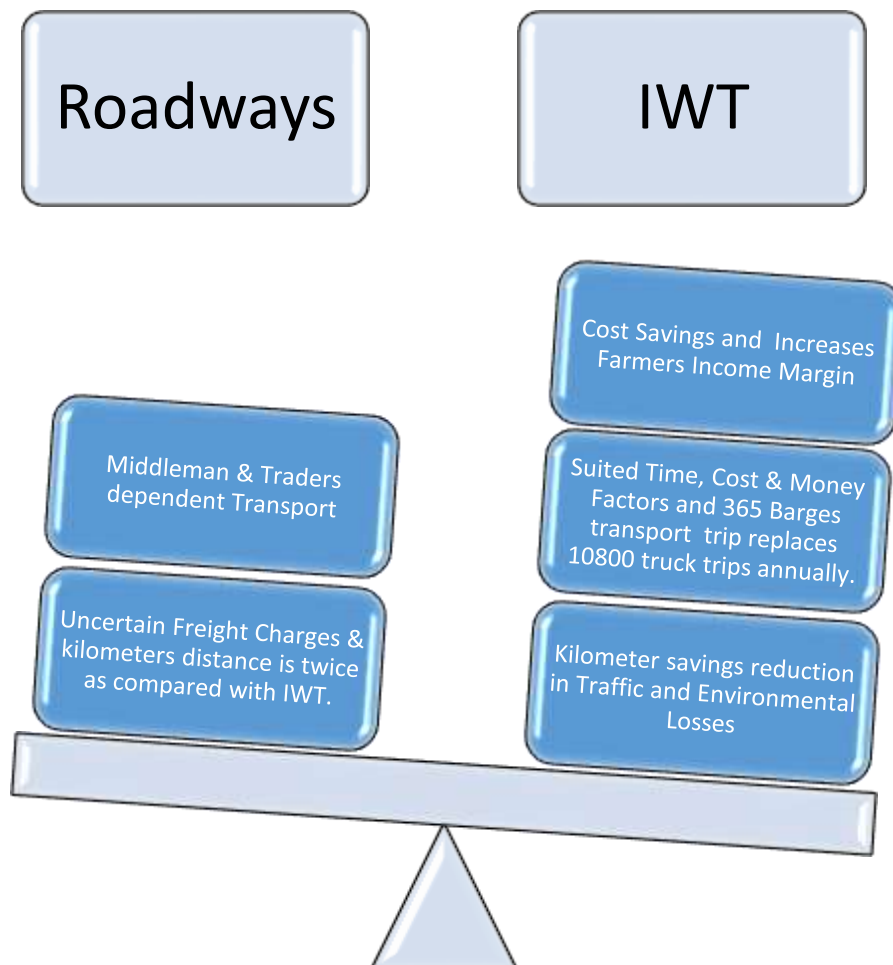


Inland Water Transport Saves kilometre transportation distance lead compared with Roadways mode of transport in this case of Vegetable cargo.

Estimation of Net Savings of Distance/Transportation Lead by IWT Mode is



4.13 Major Comparative Economic Benefit of IWT over Roadways Transportation Mode for the case of Vegetable Transportation form Saidpur to Varanasi



(Fig No.116. Comparative Analysis of Roadways & IWT)

4.13.1 Assessment of Milk Market Supply Chain arrangements at Varanasi region and how Inland Water Transport concept offers benefit to Milk Product business

Milk production is allied activity done with agriculture in Varanasi and Ghazipur region, Dairy business has significant contribution for livelihood generation among Uttar Pradesh farmers, State government has also reinforced dairy business in many aspects by setting up of milk marketing federations and milk processing plants in region.

Uttar Pradesh is largest milk producing state and dairy business is promoting subsidiary occupations in the state, Dairy farming's offers great self-employment potentials.

After implementation of national dairy development program various large scale enterprises were established in the dairy sector at Varanasi and commercialization of the dairy farming come up.

Milk produced on the farm is being sold through various marketing channels and farmers sustain on only marginal profits.

Inland Waterways Transportation has potential to provide the logistics support to the dairy owners/Individual Milk Producer which falls under our hinterlands of NW 1 over river Ganga, on time transportation of milk from dairy farms/Gramsabhs to the Wholesale milk markets in Varanasi can help farmers to generate more incentives

Inland Water Transport may offers support in implementation of National Dairy Development Programme by providing logistics support and facilitates marketing of Milk related products at cities located along National Waterways -1 hinterland.

Survey of wholesale market of Milk at Varanasi

Wholesale market of milk "Dudh Mandi" is located near Varanasi Cannt area, where approximate daily 200 - 300 Milkman of across region reaches here for selling their milk produce in Doodh Mandi located in Varanasi.

Milk producer from Chunar, Chandauli, Kaithi, and Ghazipur also comes every day to this mandi by help of small trucks loaded with Milk, Khowa, Dahi, Paneer and Maatha etc. The milk are related products are sold every day for approximate up to 5000 Litters in this Mandi The Milk production hinterlands are well located along the banks of river Ganga. Personally being researcher I have visited to the several dairy farms and milk co-operative societies who dealt in the business of milk at Varanasi region.



(Fig.117 View of Wholesale Milk Mandi, Varanasi)

Ghazipur district is well known for its milk and khowa production in the entire Purvanchal Region and every day there is significant supply of khowa and milk products to the wholesale market in Varanasi.

The development of Inland Water Transportation sector at Varanasi region may support milk producers of the region in carrying their milk daily on IWT vessel so they can easily commute to Varanasi City “Rajghat” and reach Doodh Mandi for selling their goods easily.

The milk product storage and transportation losses are huge due to rise in temperature, hence IWT barge can offers the specialized cost effective refrigerated transport facility powered with Soalr energy.



(Fig. No118. View of Milk Trades in Varanasi region)

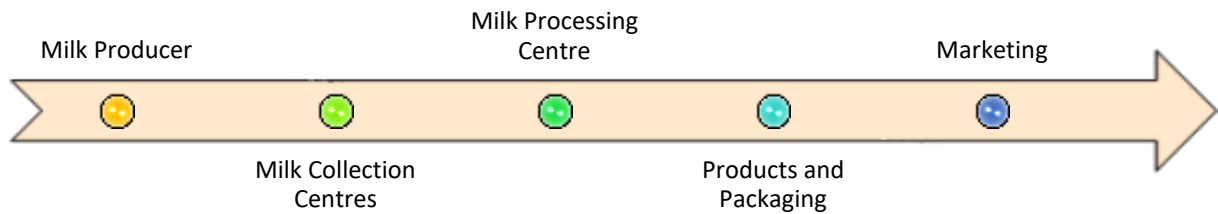
4.13.2 Survey of Milk Marketing Federations in Varanasi region

Dugdh Utpadak Sahakari Sangh Ltd known as PARAG Milk in the region, the interview was conducted with the Manager of Parag Milk, Co-operative Society. The interactions with him has reviled information that their milk processing plant are located near Ramnagar, Varanasi where 30000 litters of milk daily brought every day from various parts of the region.

The Inland Water Transport Multimodal Terminal at Varanasi is also developed near to the Ramnagar area and proposed Freight Village is also upcoming in that region hence, there is

good prospect of establishing Milk Processing plant near to the IWT terminal Varanasi and Milk is also easily collected from rural hinterlands.

Milking of chattels are allied economic activity that popularly carried in rural villages, in fact Milk Production .

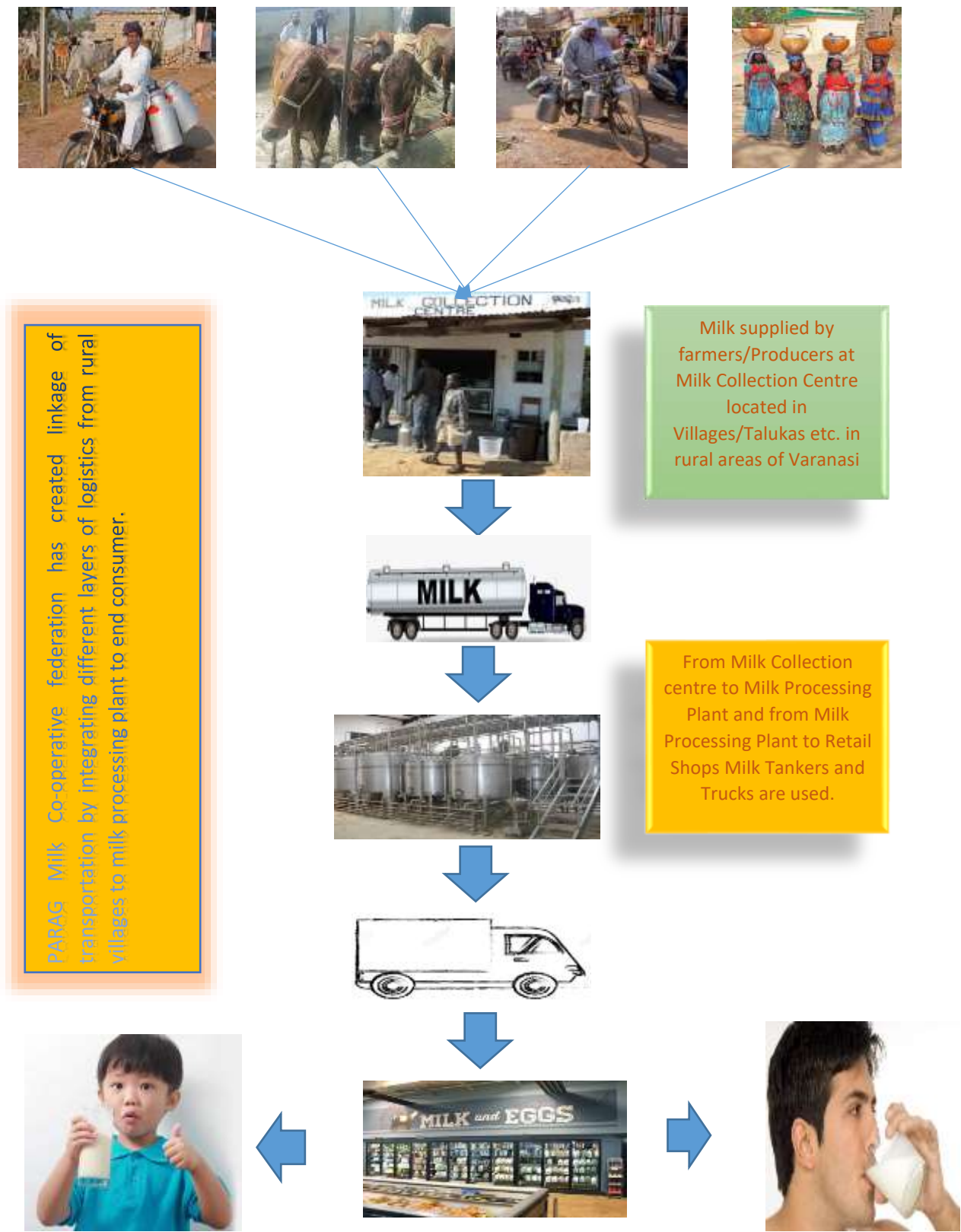


(Fig No.119 Understanding of Value Chain of Milk co-operative society business of Parag Dairy)

The milk co-operative society business were more emphasised in organising the different tire of logistics arrangements with their business. The efficient transportation and managing logistics is the key model of this milk co-operative business.

The logistics and supply chain reliability with Inland Water Transport mode may offers huge economic cost savings in manging daily transport in this sector, secondly the large rural catchment areas are served with IWT services hence the rural connectivity and transport efficiency with IWT is more possible.

Present Model of Supply Chain followed at PARAG Dairy at Varanasi.



PARAG Milk Co-operative federation has created linkage of transportation by integrating different layers of logistics from rural villages to milk processing plant to end consumer.

Milk supplied by farmers/Producers at Milk Collection Centre located in Villages/Talukas etc. in rural areas of Varanasi

From Milk Collection centre to Milk Processing Plant and from Milk Processing Plant to Retail Shops Milk Tankers and Trucks are used.

(Fig No. 120)

4.13.3 Inland Water Transport boost Prospects of Dairy Industry at Varanasi region.

River Ganga touches thousand kilometres of rural hinterlands along its bank, therefore the possibilities of developing milk collection centre in the rural villages and towns touches NW-1 banks is more and it can be easily created IWT transport linkage to the nearby city.

The dairy industry and products demand are always high, in fact there is huge gap in demand and supply, in this scenario development of milk collection centre along the banks of river Ganga with created IWT transport linkage for milk transportation IWT milk tanker vessel may will boost productivity and efficiency of dairy industries

The dairy industry flourishes along the bank of river Ganga due to various reasons, in interactions with Maruti Dairy Farms owner has provided information that, river Ganga facilitate in cattle rearing in many aspects, the open banks of river Ganga provides restricted free space for grazing of cattle.

As now a days year around agriculture patterns are followed and in ongoing in such circumstance the limited open space for cattle is remaining, the river Ganga Banks nourishes green fodder to the cattle and grazing of cattle facility support dairy farms owners in reducing their cost of feeding too.

The green grass along the river bank is more liked by the milking cattle and their milk productivity is also increases by grazing green fodder on the banks of river Ganga.

Cattle lives in natural environment and cleaning and bathing of the cattle is also easily done near to the river bank. Cattle drinking water is also arranged from the river.

Therefore most of the dairy owner of the region prefers to establish their dairy farm near to the bank of river.



(Fig. no. 121 View of Dairy Farming near Village- Kaithi, Varanasi)

Development of Milk collection Centre along the banks of river Ganga with creating Inland Water Transport linkages facilitates milk producer of Varanasi region in development and marketing of their milk products. Under Jal Marg Vikas Project and Arth Ganga program government can make efforts for development of community jetty with facility of transportation and storages of milk produce.

In future milk clusters like Ghazipur, Saidpur, Kaithi, Chanduali, Chunar etc. areas of the region linked to the Varanasi city with IWT mode and they utilise IWT mode of transport for transporting their dairy produce to Kashi city.

The Milk Co-operative federation like PARAG will also use IWT mode of transport and develop Milk collection centre near to the villages along the Banks of river Ganga.

The Dairy owners liked to establish their dairy near to the banks due to various indirect benefits and the availability of transport linkages with reduced cost is incentive for them.

The IWT development facilitate the National Dairy Development program in Varanasi region and reliable IWT services manages the transport of dairy products without delay and also refrigerated dedicated barges can reduce the losses also.

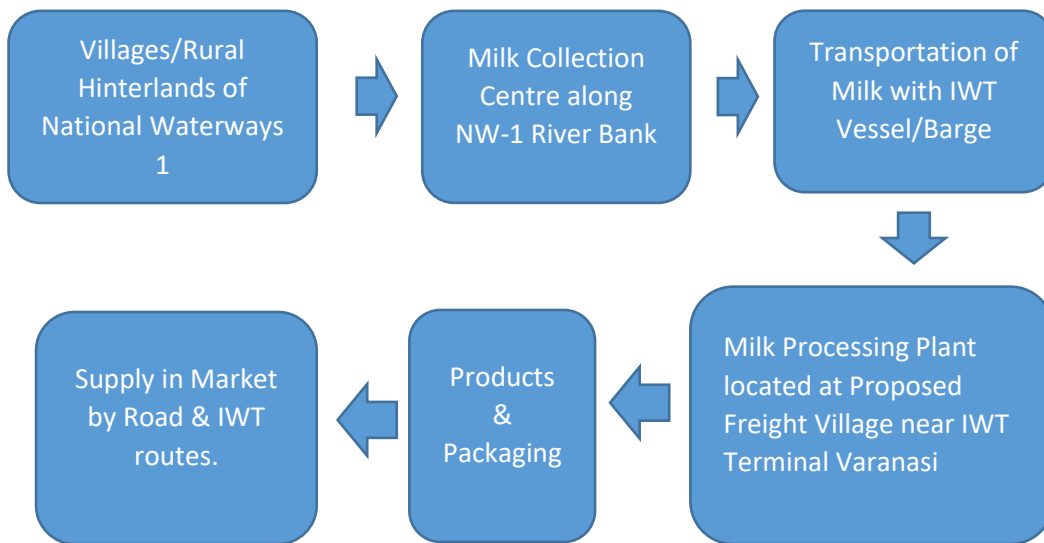
The IWT linkages rural hinterland with urban cities with minimum distance and development of hassle free, reliable services for transportation of milk produce facilitate dairy business of the region.

Possibilities of development of Milk Collection Centre along the banks of NW-1 rural hinterlands at Varanasi region and transportation of milk produce may arranged IWT Vessels/Barges etc.



(Fig. No .122. Representation of IWT routes, water transport linkages with Milk Collection Centre likely to be developed along banks of rural hinterlands on river Ganga)

Future arrangement of Supply Chain with integrating Inland Water Transport

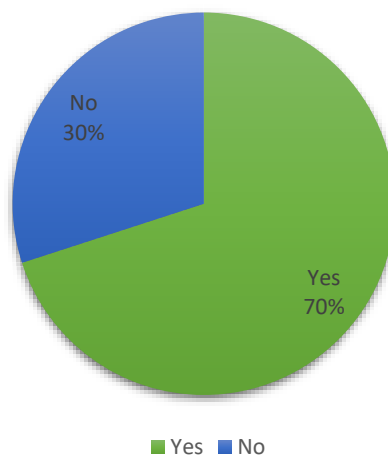


(Fig. No. 123)

Perception survey of Milk Producers regarding usages of IWT routes for transporting Milk Produce.

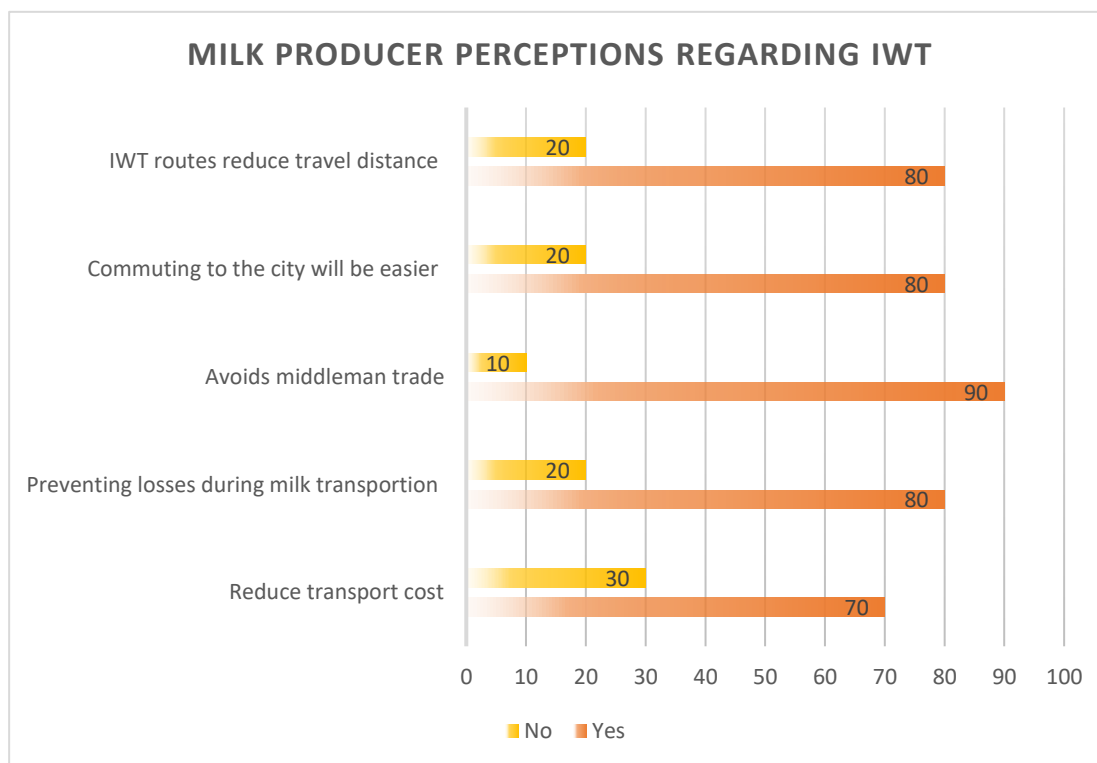
At Milk Mandi Varanasi the perception survey was conducted regarding proposed IWT and their usages and strategic importance in transporting Milk produce daily, approximately 50 survey sample collected randomly in the Mandi to know the readiness and acceptability of new transport mode by the Milk Producer of the region

Will you use IWT for Transporting Milk



(Fig No. 124. Willingness of Milk Producer in using IWT services for Transporting Milk Produce)

The detailed questions were also asked with milk producers trading in Doodh Mandi Varanasi, the majority of survey population has given feedback positive and they have sense of acceptability for Inland Water Transport. The benefits of IWT is known to the milk producers, but in lack of reliable infrastructure, water transport they are unable to use.



(Fig No. 125. Graph showing feedback of Milk Producer regarding IWT)

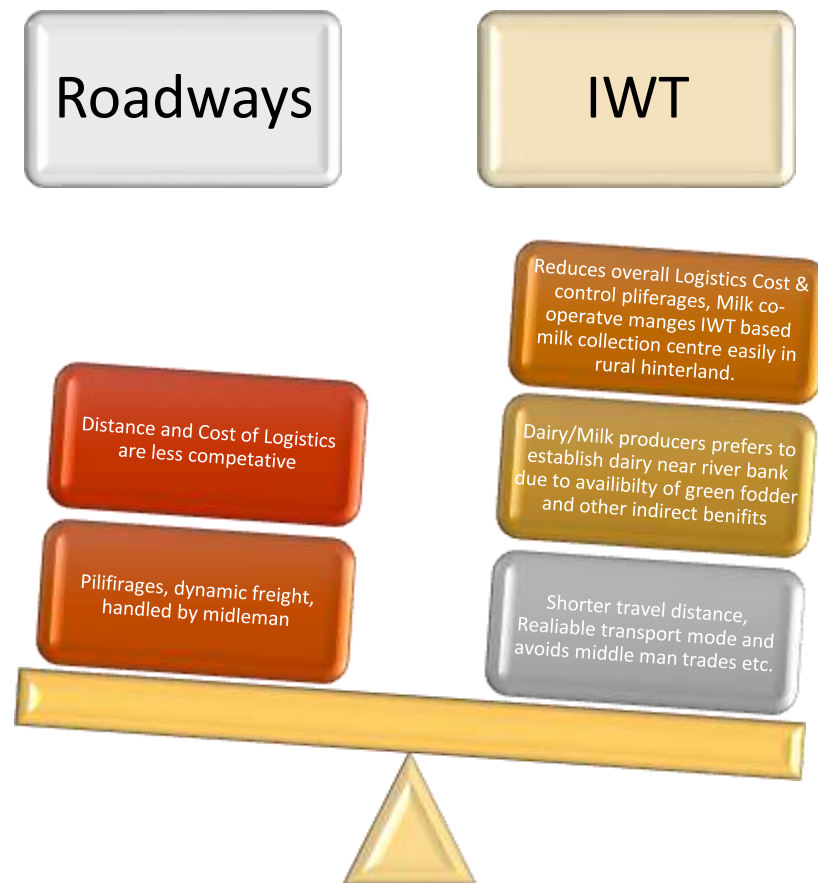
Milk producer aware about the benefits of riverine transport, sometimes they have tested it with help of country boats also but in lack of reliability they are unable to use it.

Secondly, most of the milk producers have opened their dairy near to the river Ganga due to availability of green fodder for their cattle and green fodders is used for increasing the lactating cattle and productivity also increases. Other benefits along the bank of river is sufficient availability of water for cleaning their cattle. The banks of river Ganga have open field area and minimal restrictions are there, Hence, several indirect benefits attract milk producer to establish their dairy near to the bank of river in the Gramsabhas located along the NW-1 catchment area.

The Inland Water Transport connectivity will ease their problem of transporting milk produce to the city easily. The reliable IWT services facilitate all around year transport of milk and reduce the transportation losses too.

IWT also avoids middle man trades in the milk sector, the small scale dairy owner can also use the IWT based route for transporting their Milk produce by themselves and maximise their profitability.

The milk co-operative society also develop their milk collection centre along the NW-1 rural hinterlands/villages and they can manage milk transportation and supply through IWT routes along the banks of National Waterway-1



(Fig. No. 126)

4.14 Economic Impact of Inland Water Transport on Fisherman Community living along the Gangetic basin.

Indian rivers are having a rich ecosystem to supports livelihoods of approx. 10-13 million of riverine fisherfolk communities who lives along the bank of National Waterways 1, the riverine fishing sector has tremendous opportunity for economic development along the Gangetic basin, it may supports rural populations economically in mitigating challenges like nutritional deficiency, problems of livelihood and unemployment etc. Systematic development of the fisheries sector along with Inland transportation sector may provide complementary benefits to the society at large. Inland Water Transportation Sector have the opportunity for promoting Blue Economy by enhancing market access for fisherman community and it may provide efficient transportation and logistics services i.e cold storage and Ice packaging facilities etc. it also sensitize various investors for establishing fish processing zones, setting up of MSME units along the hinterland of NW-1 the thousands of fisherman community may benefitted.

Riverine fisheries sector directly offers health benefit to the population provides low cost protein, an alternative source of nutrition support to the poorest sections of society, this sector can play a critical role in addressing food security issues at a larger scale for unnourished populations.

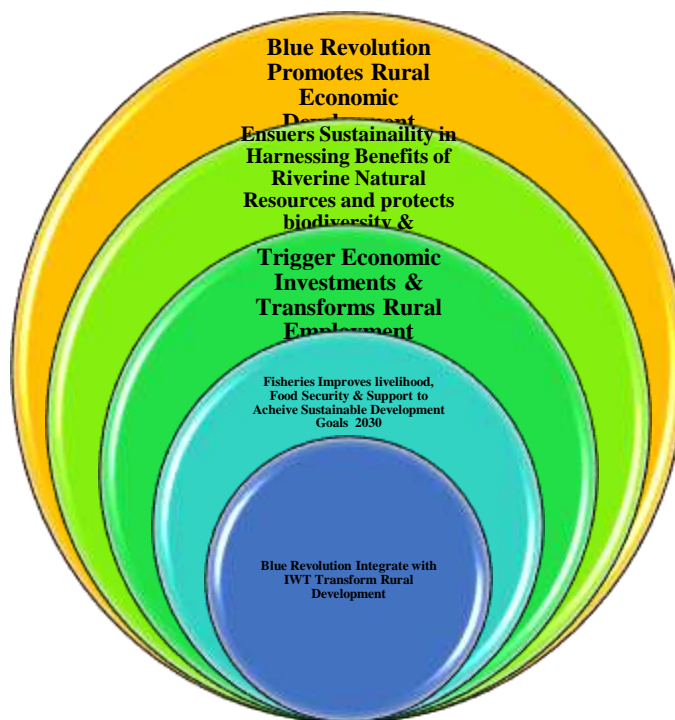
The development of riverine fisheries along the Ganga may curb the problems like loss of bio-diversity from the river, reduce poverty of fisherfolk community, solve nutritional deficiency issues and solve the problems of rural unemployment etc. Improved fisheries management may enhance environmental planning, protects marine species in the Ganga, efforts may strive in conservation of eco-system and biodiversity too.

The promotion of domestic and international fish trades enhances food security, create livelihood opportunities, raise domestic income for local population, the trades of indigenous fish carp in foreign markets may generates a sizable amount of earning of foreign exchange reserve for our country, fisheries creates various employments opportunities at all levels of economic sectors.

The states like Uttar Pradesh, Bihar & West Bengal where the large share of populations was living in the rural hinterland, these populations are very poor and maintaining low socio-economic profile, therefore promotion of rural economy should be the top most priority of government, millions of populations living along Gangetic basin are having challenges of undernourishment, poverty and unemployment hence the riverine fisheries under Aarth Ganga project may become bloom to them.

There can be many reasons for rural poverty in our country but rural economics are multifaceted and interwoven with agriculture and livestock productions. The fisheries are one among them which has greater potential to support rural non-farm economic activities, the states like Bihar and Uttar Pradesh where the situations of migration labour are venerable hence under present condition the effective solutions can emerge in the form of promoting riverine fisheries sector along with the IWT sector, this integration of economic activity along the Gangetic basin may engage rural youths in the productive sector and offers various remunerative earnings near to their home town.

Inland Water Transportation sector generates diverse economic opportunities in the country especially along the rural hinterlands of National Waterways , The successful implementation of project require various Institutional and social involvement, the riverine fisheries sector may promote sustainable rural livelihoods and engage thousands of fisherman rural populations in remunerative economic activity, it may promote various self-employment and economic investment opportunities at primary, secondary and territory levels of economy



(Fig No. 127 Blue revolution Integration with IWT mode)

4.14.2 CHALLENGES OF FISHERMAN COMMUNITY LIVING ALONG NW-1 BASIN:

Ganga basin has various river headwater tributaries flowing through 10 states of India, flood plains of Ganges are the largest landforms of alluvial soil in the world and it has developed complex human cultures and social dynamics along its basin. Gangetic riverine forces have triggered to establish various economic centres and created multiple self-employment opportunities along its hinterlands. The development of inland river fishing is one among them where millions of fisherman communities are meeting their livelihood since ages.



(Fig. No. 128)

The river water are having varied usages and equated the distribution of waters for flourishing agriculture activities, water supply, hydropower and urbanization etc.

But looking up the status of riverine fishing and fisherman communities living along Gangetic basin having devastating impacts on their livelihood due to long term ignorance of making investments in the development of riverine fishing activities by the federal and state government, fishing activities should require development equally along with any other projects undertaken on the rivers Ganga to protect livelihoods

Across India approximately 300 different types of freshwater fish species are found hence the sector has potential to provide economic supports to the largest fisherman community living here as compared with any other than the world.

The fisherman community is venerable and getting poorer over the years although they in the trade of important commodity, but they are facing challenges of the non-regulated market practices, secondly at the primary level, they are non-cooperative so middleman can easily exploit them.

The Fisheries Marketing Intermediaries have created an association for trading and retailing arrangements of fisheries, therefore aggressive bargaining can't done by the fisherman, the buyers/traders groups cumulatively follow malpractices during auction of fishes in primary market, the indirect cartel formation by the marketing intermediaries affects margin of fisherman.

4.14.3 POSSIBLE CAUSES OF DECLINING FISH PRODUCTIVITY FROM THE GANGA

- Declining river water level and fragmented flows of rivers drastically affected hydrological conditions in the river.
- Increasing pollution level, rampant sand mining, the encroachment of riverfronts, and unregulated over exploration of fish resources during breeding seasons is probable cause of declining fish density.
- Seasonally dynamic climatic changes, rainfall shortages restricted flows of rivers due to constructions of dams and hydropower projects result for declining of biophysical, ecological and social integrations for fisheries development.
- Hindrance in river flows, the poor water levels have declined fish resources and affect the fish migratory routes along the upper stretches of basin.
- Degradation of water quality and excessive siltation has affected aquatic habitat
- Lack of regulatory measures in monitoring of the overfishing activities, especially for the Indigenous fish species and other aquatic animals.
- Inefficient marketing practices followed by various marketing intermediaries, the fishes are perishable products therefore preservations and cold storage for retaining of fish harvest are required but there is lack of necessary infrastructure.
- The lack of infrastructure and low socio-economic profile of fisherman community compel for selling fish harvest at lower price to the marketing intermediaries for meeting their day to day needs, they lacks in financial acumen.
- Lack of advanced skills and education among the fisherman community.
- Decreasing scale of productivity and seasonally fluctuations of fisheries catch has created uncertainty of livelihood among the community.

4.14.4 BENEFIT OF DEVELOPING RIVERINE FISHERIES ALONG WITH IWT SECTOR

Riverine freshwaters have multiple economic centric advantages, our nation is continuously striving to harness the potentials of available natural resources for achieving sustainable economic development objective, and the development of marine resources may leads for gaining rural economic development by decreasing poverty, food insecurity and uncertainty of livelihoods.

IWT sector may help to improve fisheries management along the Gangetic basin by ensuring necessary -logistics infrastructure support along NW-1, secondly the development of cold chain storage facilities may help fisheries sector for better economic outcomes.

IWT & Fisheries sector together can generate employment opportunity in rural areas, the integration of both activities may drive sustainable development, it helps Biodiversity conservation, promote riverine fisheries, ensures nutritional support and provides food security, generation of rural employment and socio-economic development etc.

The poor and undernourished fisherman communities living along northern Gangetic plains are mainly reliant on nutrition support received through riverine fishes, it has played vital role in getting locally sourced low-cost protein to the poorer, the fisheries can ensure food security, nutritional and livelihoods support to the millions of populations.



(Fig. No. 129. Benefits of developing riverine fisheries along NW-1)

4.14.5 CLASSIFICATION OF FISHERIES MARKETS

Primary Market: This market is located just nearer to the source of production like a fishing pond, fishing harbours, fish landing centres, freshwater rivers fishing sites etc. this type of markets are mainly dominated by fisherman and vendors.

Secondary Market: The market is located mainly near to the smaller towns or clusters, this market runs through a fishing retailer or local vendors who sell the fish to the final consumers.

Super Secondary Market: This Market is located in bigger cities or Fish Terminal Markets, where wholesalers, retailer, cooperative societies and other intermediaries were functions for trade of fishes.

Export Market: International markets are mainly run through marine exporters where various exports and fish processing industries generate various types of value added products for fisheries and supplies fishes in international markets



(Fig No. 130)

4.14.6 STRUCTURE OF FISHERIES MARKETING CHANNEL & INTERMEDIARIES

Indian fisheries markets are segmented into two different parts i.e domestic fisheries market and export fisheries market, the efficiency of supply chain plays a critical role in minimizing post-harvest losses and prevent price fluctuation by the intermediaries during marketing activities.

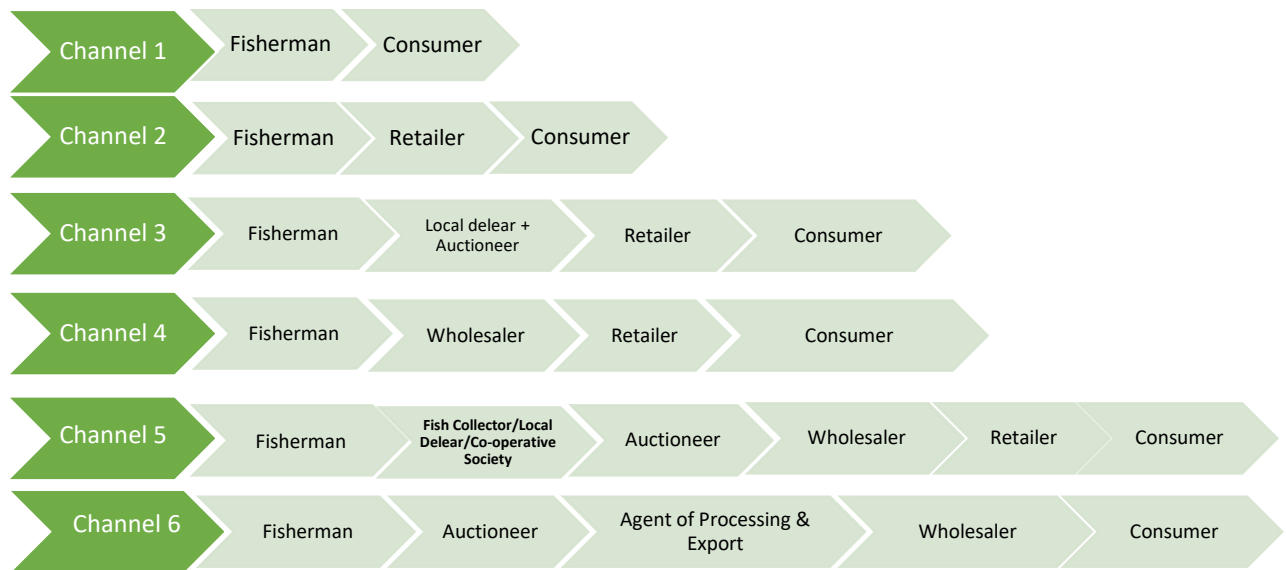
The demand and supply factors highly impacts price fluctuation during marketing of fisheries, the shortage and wastage of raw materials resources throughout processing at industries levels may lead for increasing final product price.

Fisheries sector is highly unorganised and unmonitored at most of the places, presently the sector has observed many loopholes in its marketing channels therefor strategic interventions are needed for development of right marketing channel.

The major chunk of fisheries markets margin were enjoyed by marketing intermediary's i.e commission agents, local auctioneers, Wholesaler and Retailer etc. the share of fisherman community are highly fluctuating from 45% to 85% at consumer level range.

Fisherman community is not financially sound and not efficient enough to perform marketing and institutional functions like creation of infrastructural facilities i.e storage, processing facility and logistics and marketing infrastructure etc. Majority of fisherman populations are poorer and venerable section of the society, therefore the day to operations of fisheries activity are heavily depend upon the finances received through auctioneer or commission agent, hence the dependency syndrome has been formed among the fisherman community and they can't came out from the vicious cycle of poverty, lack of institutional financial credit, lack of marketing knowledge, over-dependencies on marketing intermediaries, lowers morale of society and becomes major drawbacks of the community.

Intermediaries of Fisheries Marketing Channels



(Fig No. 131)

The channel 1 to channel 5 are mainly considered for operating in domestic marketing and channel 6 are followed by dealing with export marketing.

The role of market intermediaries in managing the supply chain of fisheries products are dominant, the larger scales marketing were done by intermediaries channels like auctioneers, wholesalers, commission agent, an agent of the processing plant, an agent of exporters and retailers etc.

The marketing efficiency and profit margin of fisherman are completely dependent upon the number of marketing intermediaries involved in the distribution channels and scale quantity marketed, it has been observed that longer distribution marketing channel reduces overall profit margin of fisherman community.

4.14.7 PROFIT MARGIN TAKEN BY MARKETING INTERMEDIARIES OF FISHERIES

Indian fisheries market deals in the trade of variety of fish species but prices are highly skewed depending upon the market demand and supply functions of that particular type of fish craps, fish vendor or fisherman deals in selling of maximum number of varieties of fish craps, but the wholesaler, agent, middleman and other marketing intermediaries they deal only in specific type of craps which has regular market demand and having the possibilities of earning better revenue.

The price and margins of fishes differs from variety to variety of fish craps, the margins of fisherman were depending upon the type of marketing channels followed in the selling of fishes at the landing centre.

The consumer price of fish in the retail markets are highly inconsistent due to the demand and supply forces, it has been observed that domestic demands of fishes in Uttar Pradesh and Bihar regions are negatively impacted during religious and festive months, but West Bengal impacted lesser therefore the demand patterns of fishes were wedged by regional and cultural patterns.

The well-organised marketing channel are required for fisheries sector to make availability of fresh fish to the consumers, effective marketing arrangements includes handling, transportation, storage, packaging, sorting and merchandising of fisheries stocks.

The objective of efficient fisheries marketing makes availability of fresh fishes at reasonable price, the retail price of fishes includes total cost of marketing and margins of various intermediaries.

Distribution channels involve local auctioneer, local dealer, broker, wholesaler, agent, retailer's etc. these intermediaries perform certain activities in the market and in return they takes sum amount of profit margin, therefore for illustrative understanding brief calculations are made for estimation of margin taken by intermediaries during the trade of ROHU fish. This fish species' are highly demanded and liked by Indian customer



(Fig. No. 132 View of fishing boats)

Trade margin % taken by various marketing intermediaries (Illustrative calculations done for Rohu fish price/ kilogram)												
Market Intermediaries	Price Received by the Fisherman INR/KG	Fish Collector/Local Dealer Price INR/KG	Fish Collector Margin %	Auctioneer Price INR/KG	Auctioneer Margin %	Commission Agent/Exporter Price/KG	Commission Agent/Exporters Margin %	Wholesaler Price/KG	Wholesaler Margin %	Retailer Price/Price Paid by Consumer/KG	Retailers Margin %	Remarks
Channel 1	160									160	100%	Fisherman - Consumer
Channel 2	129	-	-	-	-	-	-	-	-	160	24.03%	Fisherman-Retailer-Consumer
Channel 3	96	108	12.5%	129	19.44%	-	-	-	-	160	24.03%	Fisherman-Local Dealer-Auctioneer-Retailer-Consumer
Channel 4	76	-	-	97	27.63%	-	-	129	32.98%	160	24.03%	Fisherman-Wholesaler-Retailer-Consumer
Channel 5	64	76	18.75%	97	27.63%	-	-	129	32.98	160	24.03%	Fisherman-Local Dealer-Auctioneer-Wholesaler-Retailer-Consumer
Channel 6	49	-	-	73	48.97%	97	32.87%	129	32.98%	160	24.03%	Fisherman-Auctioneer-Agent of Processing & Export-Wholesaler-Retailer-Consumer

(Table No. 21)

4.14.8 FISHERIES VALUE CHAIN:

The value chain arrangements of the fisheries sector are very complex in nature, The dynamic competitive interventions steps followed in performing of key functions under Value Chain, the functions of production, marketing and distribution of fisheries is highly unorganised sector in our country and majority of fish landing centres/harbours practices unregulated marketing

Trade functions of the fisheries sectors are carried by private parties and presently there is the lack of government regulations in monitoring of fisheries marketing activities, another challenge of transportation of fish stock from rural hinterland to the urban markets by the fisherman community.

Fisheries are highly perishable item so it requires proper cold storage, packaging, faster logistics arrangements for safer delivery of fish stock up to urban market areas, but unfortunately Indian fish market sector is facing major challenges of perishable and post-harvest losses, the fish can't retain for a longer time due to lack of cold storage facility so fisherman are bound to sell their fish harvest at lesser prices. The lack of infrastructure and unregulated market practices reduces bargaining powers of fisherman thus larger share of profit margin percentage were enjoyed by the middleman and other intermediaries.

Effective Marketing practices can play a vital role in raising of fisherman profits margin, the unregulated market intermediaries activities have already exploit the interest of fisherman community therefore establishments of systematic marketing controls may prevents various losses.



(Fig. No. 133)

In order to improve economic situations of the fisherman community, introduction of fair trade practices and regulated market are needed along National Waterways 1, the IWT sector may provide a platform by creating new markets along with ancillaries facilities i.e logistics, cold storage and E-commerce etc.

Perishability losses are the acute problem before the fisheries sector and marketing channels are dominated by the large number of middleman therefore fisherman has to undergo through various bargaining episodes and suffer losses in end.

Small Fishing Jetty can be developed along identified fisheries clusters on NW-1 where Gangetic fisherman may utilize IWT assets for marketing of their fishes, IWT may also help women fish vendors to establish Kiosks along the Ferry Ghats and promotes retailing of fishes, secondly the development of E-commerce platforms helps fisherman community in direct selling of their fisheries stock to the end consumer, the E-commerce will eliminate marketing intermediaries interference and protect the fisherman margin.

Marketing of fisheries follows nine different types of costs, the expected expenditure of cost incurred are shown in % during maintaining of the value chain. ¹⁴

Items	Cost incurred at different levels of marketing intermediaries				
	Fisherman/ Producer	Local Agents/Dealer	Auctioneer	Wholesale r	Retailer
Handling & transport	40%	41%	42%	31%	22%
Loading and Unloading	-	-	10%	7%	5%
Container	20%	41%	4%	15%	17%
Ice/Water	-	13%	11%	8%	11%
Toll	-	5%	-	8%	6%
Electricity	-	-	11%	8%	11%
Rent	-	5%	11%	8%	11%
Wastage	-	-	-	-	6%
Others	40%	-	11%	15%	11%
Approx. Total Cost Rs./Kg	5/Kg	6.96/Kg	10/Kg	10/Kg	15/Kg

Source of Data: Department of Fisheries, Agriculture University, Bangladesh

(Table No.22 Cost incurred at different levels of marketing intermediaries)

It has been observed that major cost incurred on distribution of fisheries product is transportation cost although it has several other cost but major expenditure is done on transportation of stock from rural places to the urban markets.

Incurring of several other indirect losses is the natural phenomena but post-harvest fishes continuously losses its weight due to drip loss, the continuous drainage out of water/nutrients from the body of fish results weight reduction of fish stock and gets dry, therefore on-time handling are required.

Fish is the highly perishable item so marketing intermediaries have the risk of suffering perishable losses whenever fishes brought from longer distances.

The fish marketing intermediaries has maintained practices of taking extra fishes without paying any cost to the fisherman while purchasing of fish harvest from them, the losses of risk burden are indirectly transferred to the fisherman community, taking an extra quantity of fish is common practice and sometimes this leads to exploitation

The urban cities, township, dense population settlements are located along with National Waterways 1, where fisheries landing centre or small fishing jetty can be developed along with

¹⁴ Department of Fisheries, Agriculture University, Bangladesh

cold storage facilities, this infrastructure supports fisherman community in creating direct market linkages.

It has been observed that long chain of marketing intermediaries reduces profit margins of fishermen's and may also increase cost burden on consumers, the promotion of riverine fisheries may provide alternative economic support to all communities living along NW-1 catchment area.

Development of fishing harbour and fisheries markets along the riverbank of NW1 may solves various issues related to the handling of fisheries stock, the largest share of Indian populations are living along Gangetic basin and consumption fishes stock in this region are very high hence riverine fisheries can helps in the reduction of various marketing and distribution costs associated with fisheries.

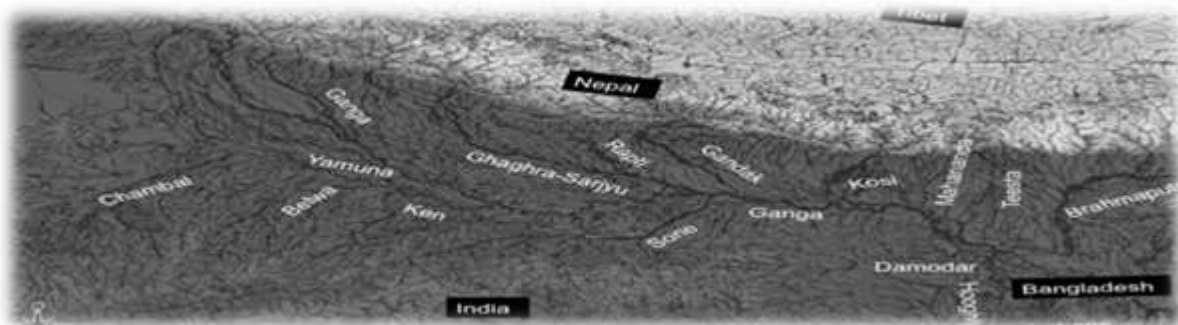
The development of fishing jetty along with ancillary's infrastructure may help fisherman community to restore their livelihood sources, secondly the hygiene issues exist during the trade of fishes, hence ancillary infrastructure helps for maintaining hygiene among the community and prevent spread of various disease.

4.14.9 INTEGARTION OF FISHERIES WITH IWT BECOMES SUNRISE FOR ECONOMY:

Fishing sector can alone benefit thousands of families by creating potential rural employments opportunities through marine resources, therefore fishing can't not termed as simple economic activity, it has complex social and cultural dynamics that influences the quality of life of millions of populations who lives along the bank of Ganga.

The development of riverine fisheries along with IWT sector enhances possibilities of optimizing riverine resources for varied economic usages, the IWT sector may develops infrastructure for efficient transportation, marketing, logistics and storage facility for the fisheries sector, additionally in return the IWT sector may also be benefitted by increasing traffic along NW-1, where fishing clusters regularly transport their fish stocks by using IWT routes hence we can conclude that "Fisheries and IWT together becomes the sunrise sector for the Indian economy"

The issue of consistent declining of rivers flows along the NW 1 tributaries like Chambal, Kosi, Sone, Ken, Betwa, Ghaghra, Gandak, Rapti, Baghmati, Mahananda, Teesta, Kamla, Burhi Gandak, Punpun, Gomti etc. main cause of declining in river flows is construction of various dams and canals that regulate the natural flow of rivers in different seasons therefore over a long period the salinity of water increase and depth of the river flow becomes shallow & fragmented thus results in drastic loss in marine ecology from river.



(Fig. No 134 Gangetic delta along NW-1)

The Jal Marg Vikas Project creates navigational channel in the river for operations of 2000 DWT barges for transportation purposes, the proposed LAD project of IWT sector will ensure for sufficient depth and flow of the river, therefore in the long run that regulates fragmented flows of river and help in restoration of marine ecology along the basin specially in upper stretches of Ganga.

Inland Water Transportation sector enhance efforts for river linkages that ensures in restoration of natural flow of river and push positively towards the protection of fisheries and aquatic life along Gangetic basin, scarcity of appropriate water depth in the rivers bed makes difficulties in conceiving of aquatic animals therefore LAD interventions project of JMVP becomes a panacea for restoring aquatic life, the availability of sufficient depth and flows in the river throughout year culminates in migration and conceiving of indigenous fish craps during non-monsoon seasons in the upper stretches of Ganga, fisherman benefitted by increasing the fish density in the river.

As per research paper of Sarita Tripathi et al, published at www.connectjournals.com/jez, J. Exp. Zool. India Vol. 20, No. 2, pp. 907-912, 2017. The study was conducted on the fish catch in the river Ganga at Allahabad form July 2015 –June 2016, the research concludes that total of 89 different types of fish species catch recorded from Ganga at Allahabad region.

The water quality and water temperature were essential parameters for creating suitable breeding condition of fishes, the LAD project may ensure for suitable depth availability in the river and supports fishes in conceiving for positive interventions that may increase the probability of rising bio stock and fish density in the river.

Since July 2015-July 2016 seasonal variation of fish catch percentage found, it is clearly indicate that different types of species found in Gangetic basin, randomly collected data from Teliarganj fish markets of Allahabad through a market survey from particular fish vendors selling fishes of local fisherman who catches fish directly from Ganga by using drag net, the fish catch data methodology help in estimation of fish populations species wise available in Ganga during different seasons in Allahabad region, the fish catch data sets directly reflects seasonal variations of fishing populations for each species available along the genetic basin, this is a clear indicator that depth of water flows regulates temperature under water that helps in maintaining fish populations density in the river.

Fish species	Winter		Summer		Monsoon	
	Average catch/day (kg.)	%	Average catch/day (kg.)	%	Average catch/day (kg.)	%
<i>C. Catla</i>	1.10	1.08	1.01	0.65	3.39	3.03
<i>L. rohita</i>	1.71	1.67	3.09	1.96	5.21	4.64
<i>C. mrigala</i>	8.80	8.57	12.88	8.19	9.37	8.34
<i>C. carpio</i>	18.94	18.44	20.53	13.05	18.05	16.08
<i>O. niloticus</i>	27.81	27.09	4.92	3.13	20.93	18.65
<i>S. seenghala</i>	11.29	10.99	26.65	16.94	10.34	9.21
<i>S. aor</i>	8.51	8.29	6.58	4.18	4.82	4.29
<i>C. garua</i>	1.96	1.91	18.58	11.80	3.63	3.24
<i>E. vacha</i>	1.92	1.87	5.90	3.75	4.71	4.19
<i>W. attu</i>	2.43	2.37	10.36	6.59	2.22	1.98
<i>R. rita</i>	0.32	0.31	3.81	2.04	5.13	4.57
<i>B. bagarius</i>	0.86	0.84	6.24	9.96	1.05	0.93
<i>L. calbasu</i>	1.55	1.51	1.48	0.94	0.45	0.40
<i>M. armatus</i>	0.31	0.30	1.45	0.92	0.21	0.19
Miscellaneous	15.13	14.74	33.82	21.50	22.70	20.22

The river Ganga is the adobe for various types of fishes species, The fishes species of river Ganga are also founding in its corresponding tributaries, previously the river water depth in its tributaries was sufficiently available that helps in retaining populations of various types of indigenous fish species but declining in the bio-diversity of tributaries river causes reduction of water level in Ganga and slowly-slowly the shallow flows of river reduces fish population percentages of Gangetic basin.¹⁵

Economic viability of riverine fishing adversely impacted by reduction of river flows, the lowering of river flow drastically impacted to the marine ecology and results for declining fish density from the river, thereafter fisherman population started facing issues of sustained livelihood because their earning are directly proportionate of fish catch percentage from the river.

The seasonal declining in fish catches percentage was observed from the above data, fish production affected in proportionate with levels of water depth available in the river, in such conditions the IWT sector may help in restoration of river flows and helps to maintain depth in navigation channel that indirectly supports fishes in migration and conceiving because fishes get conditional water temperature as per suiting to the marine requirements.

Fragmented and shallow flows of river in long-run affected fisheries productions in the upper stretches of Ganga and declines water quality index that results in significant losses of fish habitat and negatively impact livelihoods sources for the millions of fisherman.

The LAD interventions through JMVP may ensures sufficient depth in the river, the effort will reduce in siltation and fragmented flows of river up to some extent, secondly bank protection works and river conservancy activities may help in reduction of siltation. Hence the systematic investments efforts helps in the development of riverine fisheries along with Inland Water Transport and improves livelihood sources for millions of fisherman community.

4.14.9 ANNUAL GROWTH RATE OF FISHING SECTOR:

The data published by the Ministry of Statistics and Programme Implementation in the progress report of Sustainable Development Goals (NIF), the three years data reveals that fishing and aquaculture activities in India has recorded continuous growth of approx.. 10 percent from 2015 to 2018 and it is expected for chasing similar trend in coming future, hence the production of fisheries and aquaculture may increase year on year and sooner the production of fisheries sector may double.



(Fig No. 134.1)

¹⁵ Economic Survey report 2018-2019, volume -2, Ministry of Finance, Department of Economic Affairs

The SDG goals dealing with interventions of protecting bio-diversity of life below the water has settled objective for advocating measures on development of fishing activities and regularly making efforts in improving scientific knowledge to enhance marine and coastal eco-systems and also provide access to the small scale artisanal fishers to the marine resources and markets. The Interventions of IWT sector may enhance riverine fish productions by providing suitable infrastructure facilities and IWT logistics offers direct supports to the local fisherman community in marketing and transportation of their fish stock.

The development of fishing Jetty under Aarth Ganga initiative may provide infrastructure supports to the fisherman, creating of fishing jetty, cold storage facility provides doorstep logistics access to the fisherman community and they easily transport their fish stocks.

The MOSPI data reflects that India has recorded significant increase in fishing yield from 3.7 million tonnes in 2015-2017 to 5.3 million tonnes per year in 2017-2018, the government has also extend the double support in buying of fishing FRP boats and supports for development of fisheries sector in India.

IWT sector may directly transfer various benefits to the Gangetic fisherman's by providing 360 degree support because one common resources water can be utilised for the development of fisheries sector and transportation sector both, hence the infrastructure development of both sector can offers complementary benefits to each other.

4.14.10 WAY FORWARD OF FISHERIES SECTOR WITH INLAND WATER TRANSPORT ¹⁶

The concept of Gangetic economics foster's in the achievement of sustainable development goals of country, the Gangetic blue economics significantly contributes in resolving food security issue, poverty alleviation, mitigating and resilience of biodiversity losses, environmental changes impact, enhancement of trades, commercial investments, improve logistics supports through Inland water transportation sector etc. The integrated development of sector may generate various employment opportunities and offers many regional economic growths.

Integration of IWT along with fisheries sector forms unique alignment of resource utilization for gaining economic profitability, India has huge presence of wide fisheries bio-diversity in the form of canals, ponds, lake, rivers and oceans etc. all resources were physically and biologically settled as per the regional context of ecosystems.

Fisheries resources are having immense economic potentials, the abundance presence of marine resources may strengthen economic structure of our country, but unfortunately, we have loosed the productive integration with fisherman community with other economic sectors, therefore fisherman gradually becomes economically backward, therefore integrated development approach needed in this sector. The Aarth Ganga concept may provide platform to integrate fisheries sector with Jal Marg Vikas Project and sets the precedent of optimum utilization of riverine resources for socio-economic development.

Fisherman communities are found along entire Gangetic basin but these communities are small-scale fisherman, secondly they have restricted themselves involvements up to the activities at primary levels only, therefore they can't get right incentive and middlemen takes more benefits from them.

¹⁶ Working Paper of Texas AM Transportation Institute, WWW. Tti.tamu.edu.

Fisheries are state subjects but it's well known fact that the sector is not grown as much unlike other sector, hence it can't be ignored because it represents millions of fisherman community and source of livelihoods. India is known for the largest exporter of different varieties of fish species in the world, under such conditions this sector creates immense hope and may become the major contributor of foreign exchange earner.

Export of marine products stands for 5% share out of the total exports volume of India, the share of fisheries sector has approx. 19% of agriculture export during FY 2017 -2018, the MOSPI data reflects significant rise in the production and exports of fisheries sector.

India has a presence of 10% of global biodiversity in terms of fisheries so our country has already rich in marine resources but inland marine resources are highly under-utilized therefore we have the opportunity to explore and generate livelihoods source for millions of populations.

Fisheries of Gangetic basin have several bottlenecks, the production and productivity are negatively impacted due to loss of marine ecology, degradation of water quality, fragmented and shallow flows of river, lack of technology intervention in improving fish breeding & conceiving, poor fisheries infrastructure, lack of institutional and policy supports, non-availability of the cold storage facility, gaps in logistics and marketing arrangements etc.

The Gangetic fisherman community follows traditional methods of fish farming, they lacks in several skills and having low socio-economic profile therefore their reaches are limited to the other economic sectors so the development of the skills and training are needed for the community.

Government should accelerate development programme for riverine fisheries sectors because the Indian rivers are already rich in indigenous fish species, these exotic fish species were demanded globally so IWT integration along with riverine fisheries sector pro-longed the impetus in realizing economic potential from Gangetic basin.

Riverine fisheries are the main source of indigenous fish resources in our country therefore primary focus should be in restoration of riverine ecosystem and positive efforts may enhance

population increase of native species in Gangetic basin.



Blue growth initiative from Gangetic basin may involve millions of fisherman and costal farmers in undertaking other economic activities along with traditional fish farming, the IWT sector helps fish farmers in increasing their productivity and marketability reach and double their income which is the part of SDG Goals.

(Fig No. 135: Interactions with fisherman community along NW-1)

Fisheries Management should go hand in hand with River Transport Management activities, the integrity of two different economic activity importantly need because of fisheries can emerge as part of the sub-sector of marine sector.

The ecological and marine conditions across Gangetic basin differs hence the cluster-based approach may be introduced for the development of riverine fisheries and interventions should be made conditioning to the suitability of fish carp as per the location specific.

The Joint efforts of State Government, Union Government, IWT Department and Fisheries Department together required to promote scientific aquaculture activities along river Ganges, The integrated and sustainable regulatory efforts are needed for sustained growth to utilize open water resources for fisheries and transport sector, presently river Ganges are facing challenges of fisheries resources depletion therefore scientific interventions requires to increase fisheries resources and also maintained the water levels for Navigation purposes, a common interventions can offers two different benefits.

In current scenario fish catches can't be done throughout year from Ganga due to varied reasons, the common water resources comes under multipurpose use therefore securing of revenue inflows throughout the year for the fisherman community is challenging hence the remedial measures may be taken in context for the development of fisheries ponds along the low lying lands of river Ganges banks, these ponds can stock various quantity fish breeds, this helps fisherman community to sustain their livelihood activities throughout the year.

The research study shows that fish catch data reflects seasonal wide variations in fish-harvest percentage through riverine fishing, hence complete dependencies of fish production through river may not become an ideal preposition for achieving regular income, hence development of fisheries pond along the banks of river Ganga may help's millions of fisherman community in increasing fish production quantity and the fish stock is always available with them that ensures regular livelihoods sources. ¹⁷

The development of fisheries stock banks in the form of riverside ponds gains many advantages like regular availability of freshwater of Ganges for the development of aquaculture under controlled fisheries environment, secondly it ensures for regular livelihoods source availability to the fisherman community, thirdly fisherman community can bargain at fair price of their produce, fourth IWT logistics supports enhance marketing capability, fifth Institutional credit support makes them independent they get freedom form the exploitation of middleman, sixth E-commerce platform helps in creation of direct market linkages, the development of kiosks along the Ferry Ghats also enhance their marketability etc.

¹⁷ Asian Development bank Briefs. No 120, December 2019, Infrastructure and Investment Planning for Inclusive Growth in Uttar Pradesh



(Fig No.136 Fisherman catching fish along NW-1 hinterland)

Idea is that government should regulate number of fishing days in a month so that population density of fishes can be maintained in the Ganga, overfishing has encompassed drastic destruction of marine ecology, therefore regulating number of fishing days may prevent in killing of juvenile fish population and prevent river Ganges from destructive fishing practices.

Government has taken initiative for identifying fisherman community clusters along the basin and select Gram Sabhas on equal distances where fisheries ponds may be developed in the identified low lying areas for artificial fish stocking and breeding. The states like Bihar and West Bengal may get more benefitted because in that reach, there is the maximum chance for availability of low lying lands that can be easily created into ponds.

As like crop cultivation, the Tal Land along the basin can be developed for nursing of fisheries of Indigenous Crabs, the nodal agencies of State and Central government may work out together for preparing Gangetic fisheries action plans.

The Fisheries Producer Organization can be formed to cater needs for management of small scale fisheries ponds along the Gangetic basin, the development, and maintenance of fish ponds on TAL Land located along Gangetic basin can be undertaken through MANREGA workers of respective Gram Sabha's found along the riverbank of NW-1, low lying lands of Gangetic basin is saline and having alkaline soil so this land is not suitable for crop cultivation hence the land can be best utilize for aquaculture activities.

Inland Water Transport infrastructure may facilitate fisheries clusters in marketing, trading, transportation and cold storage of fish products, the public private-partnership investments can

be made for the development of fishing jetty along the fisheries clusters and promotes the establishment of various MSME that deals in the processing of fisheries products.

The IWT sector may encourage for promoting Public-Private Partnership to leverage private sector investment in the Gangetic fisheries sector, IWAI may create the trunk infrastructures and invite PPP investment under O&M model for the development of Fishing Harbours, Coastal fishing ponds, Fish Processing Zones etc. along NW-1 hinterlands.

Presently fisheries sector of India is highly unorganized therefore fisherman community are more exploited by the agent and middleman, in order to resolve this issue government should regulate IWT and Riverine Fishing sector, the Aarh Ganga Project can be the ideal arrangements for monitoring of the development of Gangetic fisheries, the aquaculture farms and fisherman's are advised for mandatory registration with Government authority and follows best fisheries management practices guidelines prescribed by the government for minimizing hazards losses, disease control, reduction in contamination and prevent ecological damages etc.

Inland Waterways Authority of India can play a vital role in the development of Gangetic blue economics especially for the fishing sector, the authority may develop modern fishing vessels design which complies requirement of river conditioning for fishing needs, the vessel should emerge as mother vessel which collects fish harvest every day from various fishing jetty located along NW-1, this fishing the vessel must have the facility of cold storage chamber where the fish harvest can be stored temporarily, loads of vessel can be discharged at fishing harbours located along NW-1 Under Aarh Gang initiative Inland Waterways Authority of India contribute by developing fishing harbours, fish landing centres, small fishing jetty along with cold storage facility and supports in development of fisheries processing clusters and markets along the banks of major cities NW-1, the authority may involve private parties investments for development of cold storage, Ice Manufacturing units, fisheries processing and packaging units etc.

Fisheries sector along NW-1 requires huge inter-sector integrations for management and usages of water resources in our country, the water resources has identified as the basic right to part of human life and livelihoods therefore effective development of Gangetic fisheries requires the setup of administrative committees with having representatives from the Ministry of Shipping, Ministry of Rural Development, Ministry of Water Resources River Development and Ganga Rejuvenation, Ministry of Fisheries, Ministry of MSME and Ministry of Skill Development, Representatives of respective State Government including representative of Jal Marg Vikas Project and IWAI. These empowered committee deals for development of Gangetic fisheries and strengthen the regulatory mechanism for optimum utilization of water resources for varied usages or governments should select any suitable model.

The government should regulate fishing sector development through compressive issuance of leasing and licensing policy for balancing the utilization of river water resources, licenses were issued by the governments to develop commercial fishponds, hatcheries and fisheries markets along the Gangetic basin, the main objective shall be the development of infrastructure, resources, livelihood security for fisherman community, welfare generations for fisherman community through recovered license fees.

The growing demand of the sector needed pool of trained human resources so Gangetic fisheries development should follow the comprehensive strategy in addressing critical issues of pre and post-harvest management, for securing to gain positive socio-economic outcomes and co-ordinated development approach required to balance the objective, optimum utilization of fisheries resources, the National Inland Navigation Institute Patna can be selected for imparting training and development programmes on development of Gangetic fisheries sector, the priority training program should be given to the youths of fisherman community living along the Ganga, NINI may prepare training module on development of fisheries



entrepreneurship, co-operative formation, resource development, Pre & Post-harvest Fisheries Management, and short term courses on Development of Entrepreneurship and Marketing of Fisheries, courses on Operations, Management and Safety of Fishing Vessels, courses on Fish Processing and Packaging Technology, Management of cold storage chain & transportation, Awareness Programme of current Govt. Schemes for fisheries development etc. the assistance and guidance may also be provided by the various specialist through NINI platform for preparations of detailed project report on behalf of interested stakeholders to apply for getting subsidy or other financial assistance etc.

Jal Marg Vikas Project has the various project affected families, they are also a part of coastal communities living along the Ganga basin, therefore under pilot phase project affected family may be taken for imparting training program on development of riverine fisheries, the initiatives may help's many Project families in gaining long term self-employment opportunity through riverine resources, the emphasis may be given for establishing fisheries entrepreneurship by these project affected families, post initial success of this model, it can be replicated to the entire Gangetic basin.

Fisheries resources are the part of a common heritage for the mankind, since ages millions of fisherman community serving to mankind in various ways, their role and participation in the development of cultural heritage is immense therefore the alive fisheries aquarium or Fish Museum can be developed at Varanasi for promoting tourism, the Gangetic fisheries and various aquatic animals can be showcased in that live aquarium/fish Museum and also brief about the history of the fisherman community, the role of fisheries in the development of the Indian economy, showcasing interesting fish species and aquatic animals found along the Gangetic basin, the fish museum may disseminates the information regarding richness of Gangetic heritage, cultures, religions, natural resources, coastal community, tourism along the Ganga, Varanasi is the ideal location for development of Fish Museum, there are millions of tourist reaches here across the world, the museum can be developed through public private investment modes.



(Fig No.137 Fisherman Selling Fishes along NW-1 Hinterland)

Fishing sector of Ganga has various challenges, to address the gaps of low productivity in the fisheries sector, especially undergoing conditioning of ecological and marine degradation in the river, therefore ensuring for the economic scale of fish production of indigenous fish species requires emphasis to create aquaculture, hatcheries, fish ponds along the bank river, economic scale of productions maybe achieved through the integration of river fishing with fishing ponds together, the density of fish in river Ganga is depleted therefore seeding of good quality fish species are needed, monitoring of fish health and feeding etc. to be maintained.

Inland Water Transport may focus for the development of strong forward linkages through establishing advanced value chain and ensures end to end marketing and logistics solutions for minimize post-harvest losses. ¹⁸

The environment and working conditions of this sector may create congenial a workplace environment that enhances to support women co-operatives, women self-help group and promotes women-friendly financial support schemes.

The holistic development efforts required for creating supply chain infrastructure, creation of processing facility, improvement of credit provisions, promotion of innovation, research, investments, quality improvement programme, food safety, testing standardization, marketing support, skill training, upgradation and focus attention for organising the segments of this sector, the comprehensive development of this sector required collaborative approach in terms of policy formulations and implementations at various levels.

Advantages of Riverine Fisheries

- IWT ensures for logistics and cold chains storage support for effective marketing of fisheries produce.
- IWT Supports in the development of Fishing Jetty, Fishing Harbours and fish landing centres along with ancillaries' facilities

¹⁸ Report on Economic and Ecological Comparison of Transport Modes: Road, Railways, Inland Waterways, PLANCO Consulting GmbH, Essen, <http://www.planco.de>

- Generation of self-employment & entrepreneurship opportunities in rural hinterlands
- Riverine fisheries help in achieving SDG goals i.e eradication of poverty, livelihoods generations, meeting nutritional supports requirements, and ensuring food security issues for the poor.
- Helps in environmental conservation, restoration and protection of marine diversity along the Gangetic basin
- Optimum utilization of land resources, converting of low laying land of Gangetic basin in fish ponds
- Reduction in migration of labour from Bihar, UP & West Bengal, Improves socio-economic conditioning of poor labourers of this region.
- Promotes private sector investments, development MSME clusters and economic zones associated with fisheries sector
- Extending credit facility, marketing support, capacity building, and training program
- Development of fisheries museum may promote tourism opportunity through this sector
- LAD project ensures the availability of river flows and increases depth in the river that helps in restoration of marine ecology by facilitating fish migration and conceiving.
- Along entire Ganga - National Waterways No. 1 fishing activity is important source of livelihood for the coastal community living near bank of Ganga, In Varanasi and Ghazipur at various locations fishing activity was done by “Nishads/Boat community.
- Every day fish was cached by using Fishnets and supply to the various markets in Varanasi and Ghazipur city.
- Every day Fisherman community at Kaithi/Tanda and other nearby Gramsabhas/hinterland on bank of river Ganga closer to Varanasi city catches fish and supply it to the main market in Varanasi for getting better price of their efforts
- Fishing is very popular activity identified on the bank of river Ganga in Ghazipur Aurihar/Saidpur and nearby Gramsabhas over bank of river Ganga, local fisherman catches fish and supply to the various markets in Ghazipur
- Fish is the important cargo which can be easily transported through IWT form the Rural Hinterland to Urban Markets, IWT sector can support local fisherman for transportation of their cached fish to the urban markets along NW 1

4.15 Inland Water Transportation Ignites opportunity for flourishing Tourism sector Economy at Varanasi ¹

Boat rides on river Ganga in Varanasi is preferable among the visitors, experiencing of mesmerized life of Kashi city with river rides along the blazes of rising sun over the Ganges melts golden reds into the river that makes the joy of moment in everlasting memories.

The Varanasi city is known for many things, but tourism of the city is major core attractor in the regional economy, the city has access of road, rail, air and waterways make this city transportation profile very different in kind. The development of Water Transport merges the all four modes of transport at one place in the city.

The river front area of Varanasi city is most popular tourism destination among the tourist, therefore overlapping the benefits of Inland Water Transport with tourism increases the economic activity along the Ganga Ghats. Being cultural capital Varanasi has rich and fruitful background and every year millions of Indian and foreign tourist visit to the city for experiencing the spirit of religious and cultural phenomena. The Ganga river front considered as sacred point because of confluence of river Varuna and Assi in main stream of river Ganga and the river is flowing in crescent shape from North to South directions which is rare phenomena in the World.

The Ganga Ghats at Varanasi daily river worship ceremony occurs that filled with prayers, fires and dance etc. this make the large attractions of gatherings every day at river side. The development of riverine transport facility along the various Ghats of river Ganga at Varanasi definitely increase the tourist ridership and helps the coastal community for increased in income generation opportunity.

The Government of India has initiated economic investment efforts for developing strategic logistics Infrastructure along the hinterlands of river Ganga for promoting regional trade, business, commerce and tourism through IWT developments, The Jal Marg Vikas Project is augmentation of river Ganga-Bhagirathi-Hooghly river system for cargo and passenger transportation purposes within low economic cost, The Varanasi region is one of the most important node along National Waterways -1, where the presence of vast regional trade commercial activities integrates numerous of economic happenings with transport, the city has already many active religious and tourism sites that declared as historic pilgrimage and it has having major significance of believe among the Hindus populations, therefore Varanasi signifies as heritage site, the religious shrines and public gatherings are very common along the Ghats of Ganga, The 84 major Ghats of the river at Varanasi portrait the city developments as centre for historic and cultural destinations. Therefore, it attracts millions of tourist every year and became famous world-wide tourism destination and popular for tourism in India. Now beginning of the development in waterfront and strengthening of Marine Transportation infrastructures may provide better availability of cruise ships, ferry ships Ro-Pax and Ro-Ro vessels etc. that tourist visitors may enjoy river rides and experience Banaras in different ways. The active boat rides may attracts more number of tourist, the development of waterfront enhances many regional economic activity along the Ganga Ghats.

The Economic Investment made towards the development of marine infrastructure at Varanasi city may increases the probability of rising tourist footfall and the presence of developed waterfront in city that becomes major attractor for spending leisure time. The presence of Marine Transportation facility along major Ghats definitely spurt for the regional economic development.

¹ Annual Tourist Visit Statistics, Department of Tourism, Government of Uttar Pradesh

Attention towards strengthening of ferry transportation services along the Ganga Ghats may benefit city commuters in many ways, currently city is facing issues of frequent traffic jams, congestions and Air pollutions etc. as the city architectural designs and town plans very ancient and the presence of narrower lanes and streets frequently creates problems of congestion and hinders intercity mobility. Therefore, the development of alternative modes of transport may facilitate commuters and save various economic cost in longer run.



(Fig. No.138 Panormic view of Ganga Ghat)

4.16 Regional Characteristics & Physical Growth Indicator of Varanasi City.²

As per the census of 2011 Varanasi city has population of approximate 1.7 Million and city is the fifth largest city of the Uttar Pradesh, the geographical presence of Banaras concentrically grows parallel to the flows of river Ganga. The city has very dense populations and mixed use of neighbourhoods where industrial and commercial activities are inter woven.

The global Identity of Varanasi city is very different, the city is internationally known for the centre of religious activities, well known for silk, carpet and cuisines etc. The riverside of Varanasi city has active centres commerce and tourism sites.

The Smart city plans has also kept consideration of improving quality of tourism and inclusive their innovative solutions for tourism development, therefore Waterways improvement-ferry/boats, ferry waterways connectivity along the various Ghats, Boat Taxi etc. will enhance the urban mobility and supports current city transportation infrastructure.

The Smart city mission will make alignment of goals of tourism development and outline the key performance indicators to the boatsman' development along the Ganga Ghats. The advanced water transport facility will increase the transit ridership and offers easier connectivity to the city.

Transitory Trends of Tourism Activity:

As per the statistics data published by the Govt. of Uttar Pradesh the Varanasi city is one of the major tourist attractor destinations and it has been observed that Kashi has millions of tourist coming from all over the world. However, the city has an opportunity to leverage its

² Final Report on 20 Years Perspective Plans for Uttar Pradesh, Nov 2002, Department of Tourism, Government of India

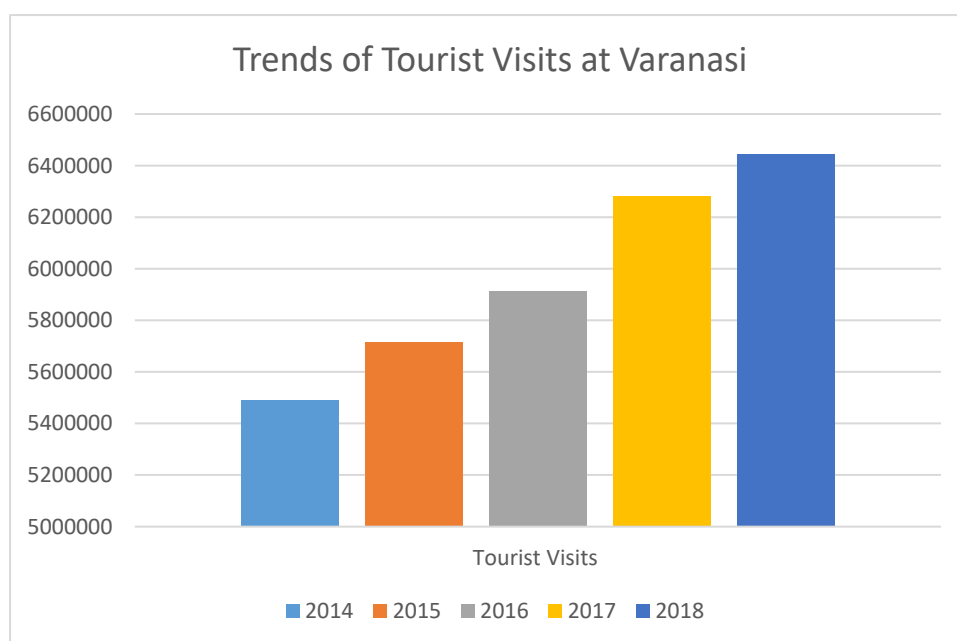
economic growth by promoting Inland Waterways Transportation that augments tourist attractions at Benaras. The outskirts of the Varanasi city is full of holy shrine dips and having self-promoted pilgrimages tourism sites for Indian and foreign tourist, the development of Water Transport facility has co-ordinated the approach of tourism planning such as tourism traffic forecast, followed the architectural design, landscaping, and overall aesthetics of city. Varanasi being national heritage capital city so infrastructure planning are done in considering local cultural heritage, religious sentiments and tourist facilities planning etc.

It has been observed that city has continuously increasing trends of tourist visits as per the data captured by the Uttar Pradesh Tourism Department

Pattern of Tourist Visits at Varanasi³

Year	Indian Tourist	Foreign Tourist	Total
2014	5202236	287761	5489997
2015	5413927	302370	5716297
2016	5600146	312519	5912665
2017	5947355	334708	6282063
2018	6095890	348970	6444860

Table No. 23 Source: <http://uptourism.gov.in>



(Fig No.140 Pattern of Tourist Visits at Varanasi)

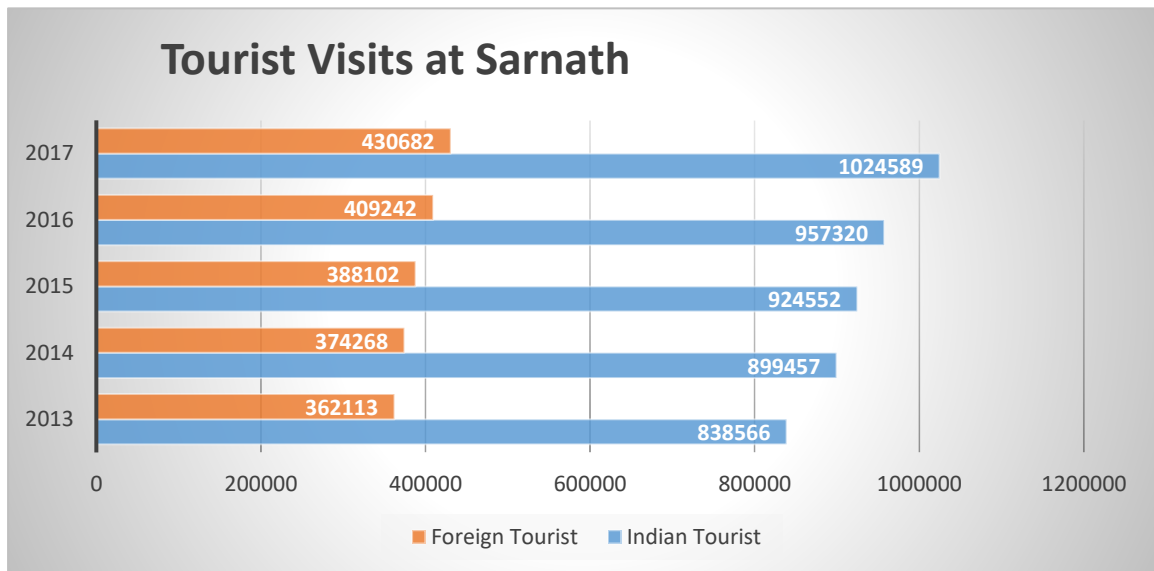
³ Annual Tourist Visit Statistics, Department of Tourism, Government of Uttar Pradesh
<http://uptourism.gov.in>

The above data published by the UP government indicates there are continuous year by year growth in tourist Visit at Varanasi.

Varanasi is the oldest living city in the world and city is believed to be greatest pilgrimage on the earth for Hindu, Jains and Buddhists. The city has a greatest cultural centre notably in the field of learning, religion, philosophy, yoga, Ayurveda, astrology, music, literature and spirituality etc. life on the Varanasi Ghats of river Ganga has changed the way to see the shrine of holy river.

Sarnath is the most esteemed pilgrimage among Buddhist population worldwide, it is believed that Lord Buddha has given his first Sermon here post attaining enlightenment at Bodh Gaya, therefore it sanctified as Maha Dharm Chakra Parivartan. The Dhamekh Stupa and several other historical scriptures and structures places special importance among the visitors.

The Chukhandi Stupa where Lord Buddha has met his five disciples, Sarnath, Varanasi area is treasure of archaeological sites the sooth glistering pillar build by emperor Ashoka in 273-232 B.C the foundation of Buddha sangha and lion on top the pillar is now called National Emblem or India. ⁴



(Fig. No.141 Tourist Visit at Sarnath)

Kashi is culturally and religiously rich heritage city, it also known as the centre of greatest cultural notably known as the centre of learning philosophy, yoga, Ayurveda, astrology, music, literature and spirituality etc.

Life along the Ghats of Ganga and the evening Arti of Holy River is greatest attraction of this place, Morning spent at the Ghats and temples is spiritually cleansing of divine thoughts of individual and local environment.

Sarnath is very important destination under Buddha Circuit who promote tourism within Uttar Pradesh and cross border tourist, this initiative venturing tourism sector and influencing life and philosophy of Buddhism followers, the Buddhism teaches philosophy of peace, love, non-violence and harmony etc.

⁴ Annual Tourist Visit Statistics, Department of Tourism, Government of Uttar Pradesh

The tourist data on Visit at Sarnath indicates rising number of tourists may also visit at Varanasi Ghats post integrated development of Buddha Circuit Tourism through cruise services that attracts foreign tourists and boost tourism economy



. (Fig. No.142. Night View of River Ganges)

4.17 Inland Water Transport Emerges Ganga Ghats as Centre of Commerce and Tourism at Varanasi:⁵

The river front is major attractor of tourist at Varanasi city, where every day lakhs of populations gathers for performing various religious activities, the local roads are connecting to the various Ghats but presently they are narrower, hence the development of Inland Water Transport system offers connectivity to the various nodes of Institutional, commercial and tourism areas.

Inland Water Transport may emerge as organised form of transport system in the city and they can also me best emerged with paratransit modes further, the Kashi city has no formal mode of transport available presently therefore the regional commuters relies on the paratransit modes only.

The investment in tourism development activities and amenities improves the greater benefits for inhabitants of the city, potential investment in marine transportations will offers sheared benefits to the tourist and local residents. Rising in key numbers of tourist visit at Varanasi directly impact over local economy and quality of life of populations. Inland Water Transport will offer assured boat services and better manages the linkages for improvement in services along the Ghats.

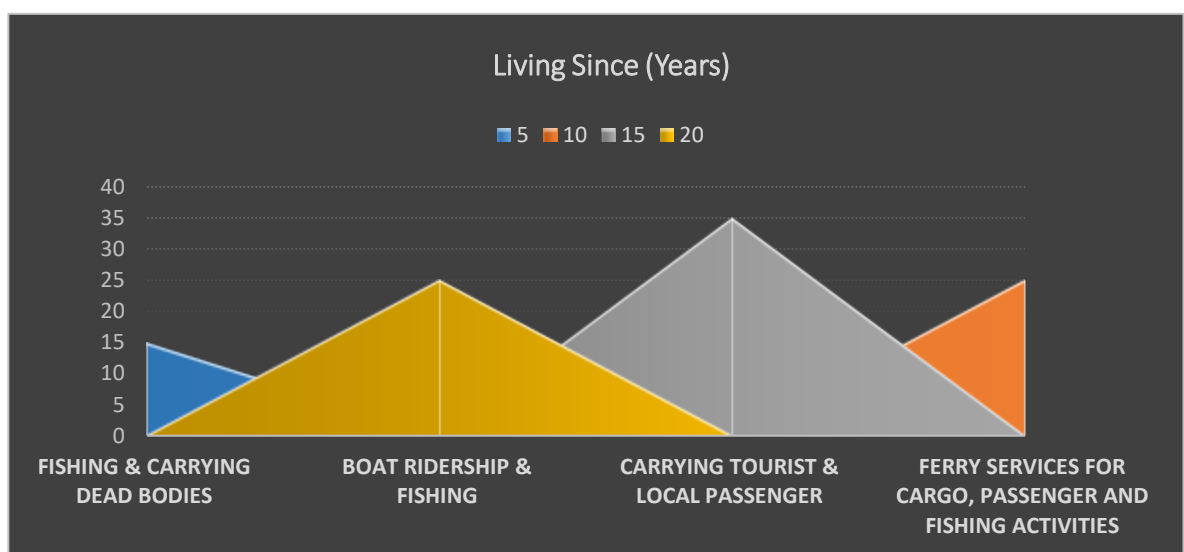
The tourism is the major part of the local economy and it is key potential growth drivers of the region, Integration of Inland Water Transport with Tourism Sector revitalizes the growth local economic trajectory.

⁵ Final Report, August 2006, City Development Plan for Varanasi, (JNNURM), Municipal Corporations of Varanasi, Prepared by Feedback Ventures

4.18 Inland Water Transport is complimentary for Tourism Sector in generating regional income & employment opportunities

The interview was conducted along the Ghats of river Ganges at Varanasi, it was observed that thousands of small crafts and boats were presently operated by the coastal community living along the Ganga Ghats like Fisherman, Boatman, Nishad community etc. are serving to the society since long years. Now the spurt for developing Inland Water Transport System may strengthen by making availability of high standard amenities and safety of boat ridership.

- How long you are living along the Bank of River Ganga and what economic activity carried out. ⁶



(Fig. No.143 Survey Graph of Community Survey)

More than 150 surveys samples were collected by interviewing coastal community along the hinterlands of river Ganges at Varanasi region, where it was found that 80 percent of the community has established them self since more than of 15 years. These community lives along Ghats or Costas of river side and the major sources of Income is through the money received from Boat riders, Fishing and carrying local goods from bank to bank of the rivers. Therefore, they were highly depended upon the economy of rivers.

In depth interview with costal community who lives along the river Ganga since more than of 5 years, they revile that their economy and earnings were highly depended upon the river resources.

The coastal populations carried out several economic activities with help of river water resources and tourism activities axis their livelihood sources.

The primary data clearly indicates that the shared populations percentages living more than approximate 10 to 15 years old, they actively participate for river related economic activity,

⁶ Primary Survey – research analysis.

as they are more experienced belongs to the higher productive age group therefore, they capable catch premium revenue through offering ridership for tourist.

The above graph represents that the demand for carrying passenger (Tourist + Local) is very higher and this segment has good revenue generation opportunity.

The Investment made by government in development of Inland Water Transport facility along the various Ghats of Varanasi will definitely support for increasing tourism business opportunity, the tourism is identified as core economic activity in the region and integration with better facility and water transports services helps in increasing economic profit of the region. Both tourism and Inland Water Transport were complimentary to each other.

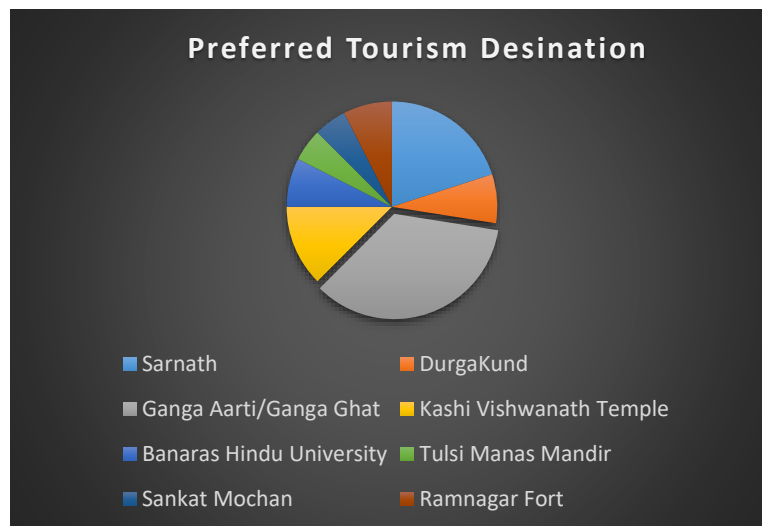
Alluring Ganga Ghats are preferred choice among Tourist:

Varanasi city is has variety of heritage sites, the Ghats are one among them that signifies the testimony of many kingdoms of India, Varanasi is Ancient city its history is more than of 5000 years old, the centre of religion, cultures and knowledge etc. it is deemed to be known as “Religious Capital of India” Varanasi is one among the seven holiest spots of India, every year in Sawan Month and Navratri millions of people flock takes the holy bath and performed various religions and cultural activities.

Each Ghats of Ganga has its own significance and many spiritual historic arches is connected to with it, Here Ganga is flowing from North to South directions in crescent shape which make it scare point in the world where people feel enormity of faith. The more popular Ghats are Assi Ghat, Dashwamedh Ghat, Raj Ghat, Man Mandir Ghat, Ramnagar Fort, Harishchandra Ghat and Manikarnika Ghats etc. at Varanasi there are more than 72 Ghats that also have its own historic arch and having its own importance.

The Random Sample survey were conducted along the various Ghats of Ganga at Varanasi and the responses were captured in the form of Short Questionnaire; the 150 responses gathered to understand about the major tourist attractors sites at Varanasi.

- ***According to you which place/sites of Varanasi is more liked by you⁷***



(Fig.no. 144 Preferred tourism destination at Varanasi by Tourist)

⁷ Primary Survey – Research Analysis.

The Maximum number of tourists has shown their interest for visiting at Ganga Ghats at Varanasi to witness the Ganga Aarti especially in Evening time

Ganga Aarti is the shining bliss of the city, the chanting of Mantra and Aarti in the evening spreads divinity in the surroundings.

Every day millions of tourist and local public gathers near Ganga Ghat to Worship lord Shiva and Mata Gange, the priest and devotes burns the incense sticks and light up Ghee Dipak of Aarti. Mother Ganga is worshiped with smell of camphor and goose bumping-inducing Aarti spreads purity in the air.

Ganga Ghats are one of the prominent cultural and heritage sites, the whole water front is full of religious activities in the evening, the panoramic view of Ganga Ghats in the evening is every tourist choice to witness and save the memory of life time. Majority of the tourist came to Varanasi to see the Ganga Ghats and sensitize the vibrant heritage cultures of the city. The presence of Water Transport facility along the Ganga Ghats attracts and accommodate a greater number of tourist, ultimately increase their revenue share too.

Water/Boat rides are preferred activities among visitors during heritage city tour: ⁸

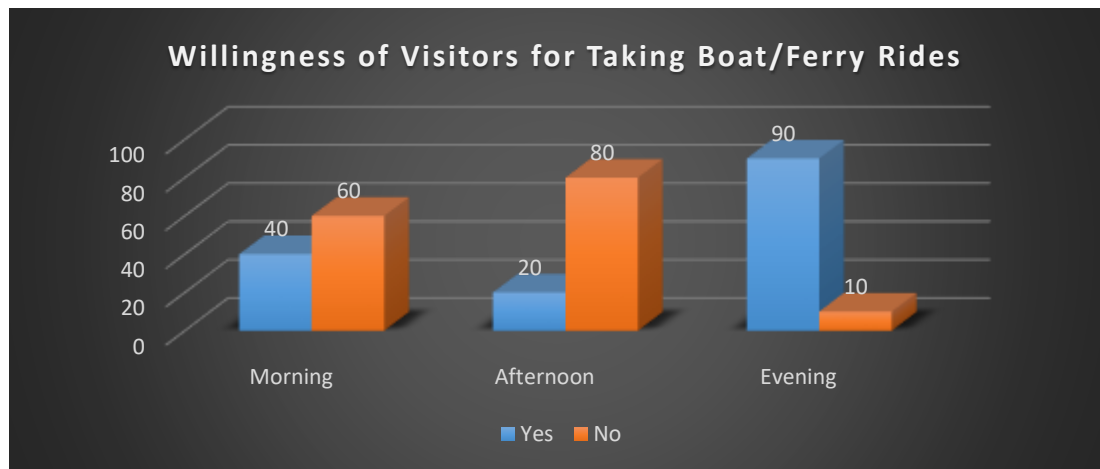
Varanasi Ghats are known for spiritually enlighten places, the city spreads along the Ghats of Ganga and sites are surrounded by temples and religious places, Chaos along the Ghats prefers to experience the activities of various Ghats through Boat rides, The divine city and dusk of Ganga Aarti and spiritual ceremony make the places vivacious.



(Fig. No.145. Night view of Ganga Ghats)

⁸ FICCI Report on Uttar Pradesh, A new Growth driver of tourism investment in India, Published in August 2018

- *Have you taken boat rides to experience the Ghats of Varanasi and what timings you prefer to visit at Waterfront?*



(Fig. No.146 Willingness of Visitors for taking Boat/ferry Rides)

The responses collected from the visitors to know their willingness for taking rides of boats and ferry to experience the Ghats, as Responses in figure no. 146 Shows that majority of tourist and local populations prefer to visit Ghats in evening time, as the development of Water Transport at Varanasi must having surge of passenger ridership in evening time only.

The analysis of primary data reveals that there is demand already in place for ferry and boat rides, therefore, strengthening of water transport services along the Ganga Ghats of Varanasi will promotes the tourism and other related economic activities.

Ganga Ghats has many religious and souvenir shops that also attract thousands of tourists for shopping along the local Haats on the river bank. Hence development of tourism activities flourishes the local regional economy in many aspects.

Ganga river front is old heritage zone of the city and this site is proposed to be listed into the heritage list of UNESO, the river Ganga is like an artery of the city, the Ghats of Benaras was prepared in different periods by different persons, it was revealed that many Ghats of Varanasi is older than the history.

Inland Water Transport offers multiple benefits in development of regional economy, as due to presence of pilgrimage the tourism activities are very highly active and dynamic in the area, there are presence of many religious, traditional and commercial activities carried out along the various Ghats of river Ganga.

Among the 84 Ghats of Banaras, the five Ghats were called as Panchtirth which considered as most scared among all Ghats i.e Assi Ghat, Dashaswamedh Ghat, Manikarnika Ghat, Panchganga Ghat, Adhikeshav Ghat. In between Darbhanga to Manikarnika Ghat the seven kilometres of water front stretch has highest concentration of tourist visits and pilgrimages, this stretch also forms the antagriha that in forms of Kashi Viashwanath temple.

4.19 Water Transportation changes movement patterns of the visitors at Varanasi:

The Kashi city is having narrower lanes and paths with dense urban settlements that leads for congestions along the roads, vehicular movements along the streets hinders a lot, the local

public and pedestrian traffic can be easily observed along the narrower streets of Varanasi city.

The urban settlements of the city having Pukka and semi Pukka houses with varying in settlement patterns and streets are Zig-Zag in nature. Therefore, the city has typical oriental class the streets are generally at lower levels and the entrance of houses having local shops lined in them which is visible till now. The inner zone of the city is very narrow and movement of traffic always stuck. But the city having advantages of larger water front availability, the stretch of city North to south along the bank of river Ganga easily connects to the prominent places.

The Introduction of riverine transportation at Varanasi provide faster access to the major nodes of the city, and majority of the populations living along the both banks of river ganga will benefitted by the riverine transportation.

Generally it is observed that the growth orient of the city is towards the west side were roads and railways are well established, however the eastern side where Chanduli district the growth is comparative less. Now with development of water transport the regional movement would be easier and Inland Water Transport offers reliable and seamless connectivity along the both banks of the river.

It was observed that every day millions of public crosses the river through bridge available, therefore the traffic surge are very high during the day starts, most of the regional populations crosses river for varied purposes like Health Care needs, Educational Institutions, commercial trades, Government offices, courts and daily needs etc.

Normally the road routes from Padao to Central core of the city takes larger time and one had to cover the distance of approximate 25 Km to reach in the mid-city, but the launch of riverine transport the connectivity to the major nodes of the city would be easier and it also help to reduce the congestion on Varanasi streets.

The development of Inland Water Transportation having various socio-economic advantages, the characteristics of the city matches the profile of water transport services, the tourist visits to the Varanasi wanted to see all important destination within short time, but due to congestions and other issues the mobility of city hinders, now the seamless connectivity with Inland Water Transport offers access to the important nodes of the city, through riverine transport the tourist will easily access to the city. Secondly the availability of reliable transports lead for the development of hotels and resorts to the opposite bank of the river also, hence the development of Inland Water Transport definitely flourishes the tourism sector and positively impact the growth of regional economy.

The travel demand of the tourist were checked and it was estimated that Inland Water Transport offers several benefits to the city, the high end of the tourist visits Varanasi to see the panoramic views of the Ghats and experience the divine activities.

In one hand the every tourist wanted to take the ferry ride over the river Ganges and see the city in new ways, the development of marine infrastructure leads for deployment of better vessels and increased the frequency and reliability in services makes the tourist attracted.

Present price level was charged for boat rides during the surge hours are very high and the income levels directly impacted the passenger's choice of travels etc. therefore the deployment of larger vessel size reduces the economic cost of travel along the waterways in one hand secondly the city exist narrower lanes and congested traffic that reduced the efficiency of mobility.

The core areas of the city has vibrant tourist spots and cultural heritage sites, and the geography of city is blessed with large waterfront that runs parallel to the city, hence the rise of riverine transport can best serve the city traffic and reduce the cost and time.

Many landing of ferry can be established and the areas of east and west side can be best served.

As the tourism prospects point the water front always major attractors and deployment of cruise services and premium and modernised boats may provide better facility to the tourist visitors.

The integration of river transport in the regional economy of the Varanasi city flourishes many activities and makes Ghats more active and vibrant.

Already the 84 Ghats of Benaras having its vital importance and city has own historical cultural heritage, but the problem faced is the lack of organised transport system for inter-city mobility, the Inland Water Transport will offers one of the characteristics of organized transport services.

The commuters can takes the riverine transport and easily access the various nodes of the city and this mobility patterns make the highly diverse economic spectrum and further connecting the river transport with paratransit modes make the travel more comfortable, economical and time saver.

The morphology of historic city and its dense urban settlement with blessings of larger waterfront best suited for the development of Inland Water Transport and this investment added the capacity utilization of the city, makes more flexible options of travel for commuters, the city has observed large seasonal variations in the traffic and congestion that also being get addressed. Inland Water Transport connects the existing markets and tourist destinations and bridge the employment generation sources. IWT has several other benefits like non-pollutant, scalable transit solutions and time saver etc.



(Fig. No.147. View of Alaknanda Kashi Cruse Vessel Playing at Ganga)

4.20 Inland Water Transportation facilitates in cremation rituals at Varanasi and supports trades of timbers used cremation

Varanasi is popular Mokash Dham since long ages, according to Hindu mythology the burning of dead body at Manikarnika Ghat and Harishchandra Ghat, the person crimated here will get freedom from the cycle of birth and death.

Millions of dead bodies from all India bring here to crimate on Manikarnika Ghat after their death.

The dead bodies are crimated with sandal wood and mango wood, therefore demand of tons of wood is there and woods are shipped from all of the region to this site.

Secondly, Varanasi has also popular Lakdi Mandi where trades of every types of woods are performed, therefore transportation demand of timber is year around at Varanasi region

Now, Inland Water Transport become game changer for transportation of timber at Varanasi, not only fire wood but also for big logs are also processed and supports furniture industries at Varanasi.⁹

Presently at Varanasi the mango woods are delivered from all parts of the country



(Source: Study of Colombia University Reports)

The increasing demand of crimation of dead bodies at Varanasi at Manikarnika Ghat resulted in overcrowding and pollution of air and water.

⁹ Colombia University Reports



The millions of Hindus dead bodies are cremated here and their family experiences pressure of numbers of dead bodies in que therefore on opposite side of river at sand banks some dead bodies are also started cremating and dead bodies are awaited for their cremations



(Source: Columbia University Study Report)

The families of diseased after performing the criminating rituals they immerse the divine ashes of body into the river Ganges. It is belief that by completing this activity the soul get freedom from death-life cycle by encouraging mingling of ashes with soil.

The riverine transport may also facilitates in criminating of dead bodies in peaceful manner at Varanasi.

The activity of boat rowing for carrying dead bodies up to Manikarnika Ghat and Hairshchandra Ghat and trades of woods are performed by the low income group of communities. The development of Inland Water Transport facility create earning opportunities for these communities.



Varanasi city is a land of heritage and cultures due to its long historical underpinnings deep rooted in day to day activities, that visualizes and can feel by any visitors at Ghats of Ganga at Varanasi.

During research visits at Varanasi, the interview was conducted with various traders dealing in timber business and tried to collect information related to cost incurred in transportation of timber form various places to Varanasi.

The timber merchants at Lakdi Mandi Varanasi has confirmed that the requirement of timer at Varanasi year around and the demand is regular, during visit at Manikarnika Ghat and Harishchandra Ghat it is clearly visualizes that for criminating dead human bodies the woods of Mango and sandal are in huge demand.

The local and small traders are using the conventional boats and carrying timber to the Ghats, easily, hence it is clear indicator that development of Inland Water Transport facility supports in performing criminating activities and trades of timber will be easier.



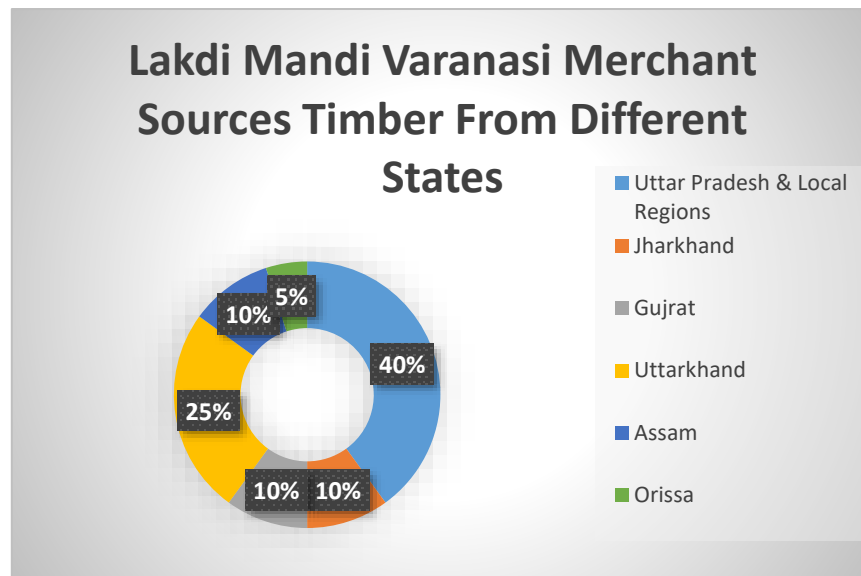
(Fig. No.148 Country boats loaded with timber/wood logs/firewood are parked at Manikarnika Ghat and Harishchandra Ghat.)14

The detailed survey of timber trades have been conducted at Varanasi, The traders has informed that timbers are basically brought here for three different purposes.

- (i) Firewood Mango or Sandal used for criminating human body
- (ii) Wood Logs for industrial and commercial purposes
- (iii) Premium quality of timber used for making furniture's and buildings doors and windows.

Therefore it is clearly confirmed that demand of timer exits at Varanasi and Inland Water Transport definitely supports in development of local trades of timber.

Further questioning with timber merchant during market survey, many merchants has confirmed that timber brought at Varanasi from many states.



(Fig. No. 149 Pie Chart-Timer Merchant Varanasi sources timber from various states)

More than 50 timber workshops visited at Lakdi Mandi Varanasi and the responses are tabulated at identified that maximum demand of timbers are sources locally along the villages and rural hinterlands of river Ganga, secondly the timbers are brought at Varanasi by roadways and railways mode. But development of Inland Transportation Infrastructure may supported the timber merchant to bring timber from Assam, Orissa and Jharkhand by using the routes of National Waterways.

The shifting of Timber on water transport may also facilitated in development of regional economy and there is certain probability that timber market at Varanasi will get double digit growth.

Timber are forest resources but availability in local market doesn't meeting its regular demand. Therefore, the timber merchant sources it from so many states.

Inland Water Transport definitely supports in reduction of total logistics cost of timber and facilitates in gaining economic profitability in timber/wood logs trades.

Case Study & Tabular Analysis of Logistics Cost Incurred on Timber Sourced from Various Places by Timber Merchants of Chauka Ghat Lakdi Mandi, Varanasi, Uttar Pradesh						
Cargo Type	<i>Timber/Wood/Logs/Firewood's</i>					
Average Monthly Demand	<i>150 Trucks</i>					
Cargo Origin Point	<i>Local Regions of Uttar Pradesh</i>	<i>Jharkhand</i>	<i>Gujrat</i>	<i>Assam</i>	<i>Orissa</i>	<i>Uttarakhand</i>
Cargo Destination Point	<i>Varanasi</i>	<i>Varanasi</i>	<i>Varanasi</i>	<i>Varanasi</i>	<i>Varanasi</i>	<i>Varanasi</i>
Mode of Transportation	<i>Truck</i>	<i>Truck</i>	<i>Railways</i>	<i>Railways</i>	<i>Truck</i>	<i>Truck</i>
Average Cost Incurred with current mode of transportation (INR)/MT	1500	2500	2800	4800	2500	3600
O-D Pairs Qulaified for IWT Mode	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
Estimation of IWT Freight						
Avg. First Mile cost INR/MT	<i>350</i>	<i>600</i>	<i>Not Applicable</i>	<i>350</i>	<i>400</i>	<i>Not Applicable</i>
Avg. IWT Freight INR/MT	<i>400</i>	<i>1440</i>	<i>Not Applicable</i>	<i>3360</i>	<i>1280</i>	<i>Not Applicable</i>
Avg. Last Mile freight cost	<i>300</i>	<i>300</i>	<i>Not Applicable</i>	<i>300</i>	<i>300</i>	<i>Not Applicable</i>
Avg. Total Loading & Unloading cost	<i>350</i>	<i>300</i>	<i>Not Applicable</i>	<i>400</i>	<i>350</i>	<i>Not Applicable</i>
Estimated IWT Freight	1400	2640	<i>Not Applicable</i>	4410	2330	<i>Not Applicable</i>
Freight Diffrennce (Roadwys - IWT) INR per Metric Tons	100	-140	<i>Not Applicable</i>	390	170	<i>Not Applicable</i>
Possibilities of Logistics Savings INR/MT with IWT routes	Yes Economic Viable	No Not Viable	<i>Not Applicable</i>	Yes Eco. Viable	Yes Eco. Viable	<i>Not Applicable</i>

(Table. No.24 Case study and tabular analysis of Logistics Cost Incurred with different modes of transportation on Timbers sourced by Merchants at Chauka Ghat Lakdi Mandi at Varanasi)

Case Study:

Case Study on Logistics Cost Incurred on Timber Transportation at Varanasi with current modes of transportation and how the Total logistics cost will be reduced with adoption of Inland Water Transport.

The primary data on total logistics cost incurred on transportation of timbers sourced from various places by timber merchants have been collected and compiled, thereafter the freight has been taken considerations for current modes of transportation which mode is higher.

Then the O-D pairs are analysed whether it is qualifying and possible to align with the routes allocated on National Waterways -1 or not, post identifications of the routes the calculations made by preparing average estimates considering distance, time, handling and cost actors associated with Inland Waterways modes of transport.

The Origin – Destination pairs identified that suited with IWT modes of Transportations for timber sourced from various locations, with tabular analysis of O-D pairs and freights of surface modes of transport is compared with waterways modes of transport. It is identified that out of six O-D pairs four O-D pairs qualified for diverting timber transportation with



Inland Water Modes of Transport, however further estimated freight difference makes only three O-D pairs suited economic viable with IWT Modes of transport.



(Fig. No.150. View of Chauka Ghat Lakdi Mandi Varanasi)

4.21 Inland Water Transport Optimizes Multimodal Transportation of Coal and Facilitate Material Flow in the region for Making Aatma Nirbhar Bharat:

Inland Water Transport may play critical role in handling of coal in the region, while interaction with stakeholders for understanding the supply chain, where they have highly welcomed the IWT approach for transporting coal from Jharkhand and West Bengal to Varanasi.

The primary survey in Chandasi Coal Mandi aims to identify the simulation of coal materials with IWT sector, the given parameters in feedback by the stakeholders for incoming and outgoing of coal from the region has best suited with Inland Water Transport Mode.

Coal is considered as an essential raw material for various industries and households in the region, the increasing focus of government on Aatma Nirbhar Bharat and facilitating for

establishing more numbers of MSME Sectors may increase the demand of Coal in Varanasi and entire Purvanchal Region.

Presently the coal are traded in large amount in Varanasi region at Chandasi coal Manadi located in the Chandauli District nearby to the Ramnagar Varanasi.

As IWT Terminal is already build by Inland Waterways Authority of India in Ramnagar on river Ganga can easily handle the coal as commodity specifically for Varanasi region. The MMT Varanasi and proposed freight village can easily manages loading and unloading of transportation of intermediate goods for transportation and storage.

Coal is Fuelling Varanasi Regional Economy:¹⁰

A fleet of trucks daily carry coal from various coal mines of Jharkhand, Odisha and West Bengal and bring to the Varanasi region at Chandasi Coal Mandi, since many decades the Coal are traded here and supports the economic requirements of coal for the region.

Presently, with discussion with various coal traders at Chandasi Coal Mandi it was identified at pilferages of coal is very high with current modes of Transportation. Hence, they hopes that IWT mode may facilitate them in better management of reducing transportation losses.

Chandasi Coal Mandi massively trades coal that develops formal economy of coal trades and transport in the region.

Ministry of coal has provided the data on Annual demand of coal in India, where it is clearly indicated that, the demand of coal requirements in domestic market is increasing steadily. It is clear indicator that the domestic consumption of coal in Indian economy is very higher, despite the efforts of government in utilizing alternate fuel, the coal need is all time high.

¹⁰ Report on Economic and Ecological Comparison of Transport Modes: Road, Railways, Inland Waterways, PLANCO Consulting GmbH, Essen, <http://www.planco.de>

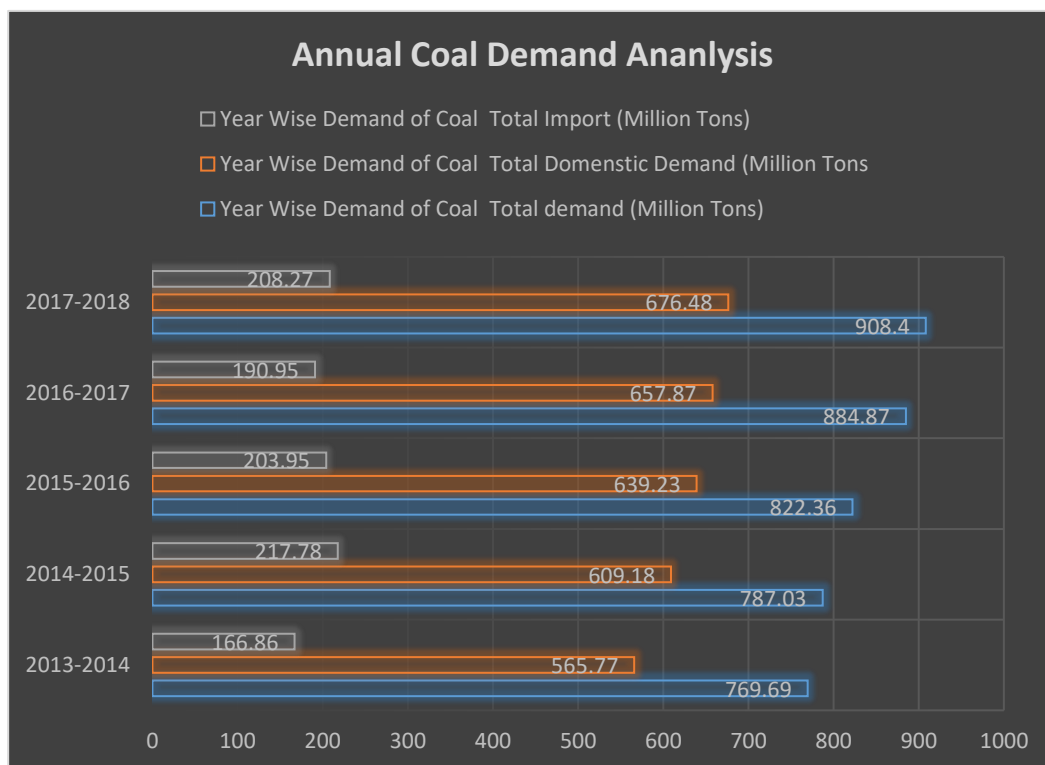


Fig. No151. Annual demand of Coal & analysis, data source: www.data.gov.in
 (Link: <https://visualize.data.gov.in/?inst=489e182c-e206-4f39-a59f-896acf4b7dff> as on 28.02.2021)¹¹

Survey of Chandasi Coal Mandi Chandauli (Varanasi) “Pragatisheel Kalyankari Koyal Vayappar Sansthan”

Wholesale market of coal is located at Chandasi near Varanasi city, Interview with the president of PKKVS at Chandasi coal mandi we come to know that there huge demand of coal in Varanasi region everyday approximate 500 Trucks movement of coal happens to the various destinations in region

Chandasi coal Mandi is the hub of coal business near Varanasi City where large number of coal traders markets coal.

Inland Waterways Transportation has opportunity here to participate by offering cost effective transportation solutions to the traders for carrying coal form Sahibganaj Jharkhand, West Bengal, Assam and Odisha to Varanasi in near future, The IWT Terminal Varanasi also likely to handle Nepal bound cargo therefore Coal from Varanasi River Port to Nepal may also likely to be transported and Varanasi becomes hub of logistics.

¹¹ www.data.gov.in
 (Link: <https://visualize.data.gov.in/?inst=489e182c-e206-4f39-a59f-896acf4b7dff> as on 28.02.2021)



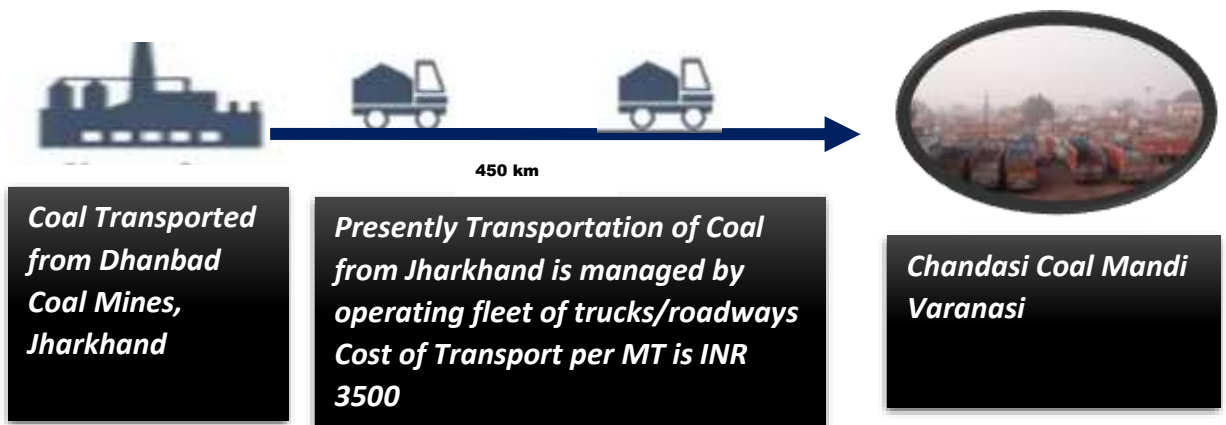
(Fig. No.152 View of Chandasi Wholesale Market near Varanasi)

During research on coal transportation management through IWT Sector at Varanasi region, the detailed market assessment have been conducted, where the analysis of the cargo movement shall be considered by present mode of transport to future IWT mode of transport.

The combination of handling coal with roadways railways and waterways possibilities are also identified. However Coal transportation can be done managed with single mode of transport and multimodal mode of transport both

But the detailed value chain analysis has been prepared for IWT mode of Transport for understanding single OD case for illustrative purposes to understand how model shift of cargo on National Waterways may saves economic cost of Coal transport by offering several other socio economic and environmental benefits.

Present Value Chain Analysis for Coal Transportation from Jharkhand to Varanasi (Chandasi Coal Mandi):



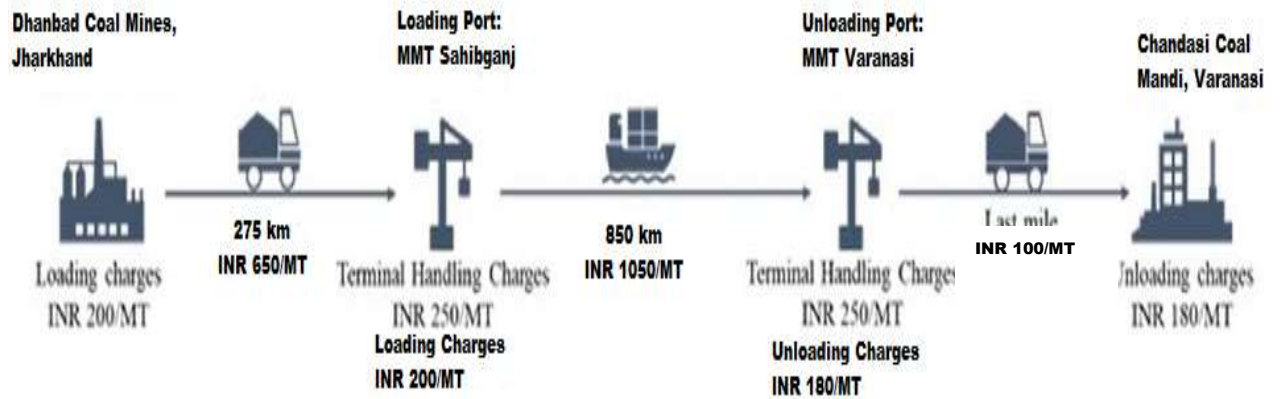
INR 3500 /- Per Metric Tons is the Present Cost of Coal

The case study was prepared to understand the cost of transportation incurred on coal with current mode of transportation i.e Roadways from Dhanbad Coal Mines to Varanasi.

INR 3500 per metric tonnes cost was identified during market survey at Chandasi coal Mandi, where cost was re - confirmed with several stakeholders of the region as on 28.02.21.

(Fig No. 153)

Future Supply Chain of Coal by Integration of Inland Water Transport:



Estimated Cost is Approx. INR/MT 3060 likely to be incurred when Coal is transported with Integration of Inland Water Transport mode.

The Multimodal transportation of Coal may integrate with Inland Water Transportation modes, where illustrative O-D Pairs of Jharkhand - Varanasi is selected for study, however several other O-D pairs are also identified during the primary interactions with stakeholders.

Coal of Dhanbad mines transported up to MMT Sahibganj by road transport thereafter with help of barge loader and Coal Handling Plant installed at MMT Sahibganj loads coal on Inland Cargo Vessel, the IWT vessel transports coal up to MMT Varanasi where coal is unloaded and transported to Chandasi Coal Mandi

The analysis of current and future modes of transportation has been done along with transportation cost assessments, the combination of multimodal transport with roadways and waterways saves economic cost of approximate INR/MT 440/- if coal is re-routed on IWT mode through MMTs along National Waterways -1

Analysis of Time, Quantity, Distance and Cost Consideration with Roadways & IWT Modes of Transport:¹²

The transportation of coal is critical for meeting the domestic and industrial requirements along the hinterlands of National Waterways -1, the data of ministry of coal on production and consumption are increasing year on years, this indicator similarly says about the economic growth of the country.

¹² Business register of economics and statistics division, department of planning, Government of Uttar Pradesh

Coal is essential fuels for several industries located along Gangetic basin, the present modes of transports are already getting saturated and increasing numbers of trucks already congested the roadways traffic. Therefore, in that situations the estimated rise of coal demand and supply will go at higher side.

Increasing numbers of surface modes of transports leads for various hazards like road accidents, damages of surface roads, overloading issues, truck repair cost, health hazards and Co2 emission and environmental hazardous etc.

Therefore, introduction of Inland Water Transport along Ganga-Bhagirathi-Hooghly River system will become fortune for the development of the nation and helps Varanasi region in economic growth.

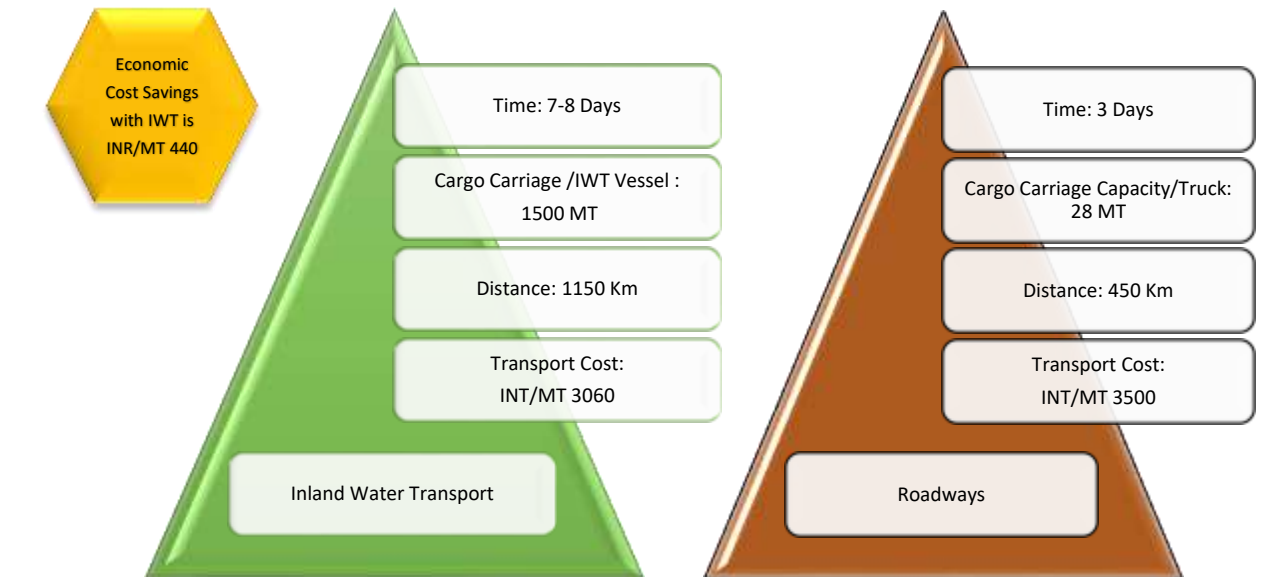
Though in above O-D case transportation of coal form Dhanbad to Varanasi, the distance with roadways is 450 Km but with IWT the distance increases to 1150 kilometres, whereas for time consideration approximate 3 Days Up and Down in case of roadways transportation, however with IWT modes the time incurred will be 7-8 days to complete the voyage. But the crux of economics comes with handling volumes of Quantity with roadways and waterways.¹³

The selection of IWT modes for multimodal transport best suited in al terms as it has higher economic volume of carrying capacity. The IWT vessel can accommodate the carriage of coal of approximately 1500 tons in one trip whereas with truck the maximum volume can be carried is 28 Tonnes in one trip, hence to carry the quantity equal to 1 IWT vessels the deployment of 54 trucks is required.

The inland water transport also reduces the total logistics cost despite increasing of distance as the volume carriage capacity of barge is higher. The detailed deliberations have been already made regarding cost assessment.

¹³ PIB News of 25-October-2016, released by Ministry of Shipping for Development of National Waterway -1 Driving Economic Benefits and Employment Opportunities in Uttar Pradesh,Bihar, Jharkhand and West Bengal

Coal Transportation Analysis for O-D Pairs (Dhanbad, Jharkhand to Varanasi)



IWT Advantages

- * Less fuel consumption reduces emission of Co2 gases. helps in reduction of carbon foot print and supports environmental initiatives
- * IWT requires lesser cost on infrastructure development
- * Minimal land required for port development and cargo handling
- * Utilization of green fuel like LNG barges
- * Lesser Accidents and safer operations
- * Higher carriage capacity
- * Reduces transportation cost

Roadways Bottlenecks

- * Fuel consumption is higher leads to increase pollutions
- * Lower carriage capacity and for meeting the target demand supply more nos of trucks deployed that results of increasing congestions over roads
- * Increasing number of road related accidents, social and environmental hazards are higher.
- * Not suited best for long distance transportation
- * Higher repair and maintenance cost and other related cost overheads are higher

(Fig No. 154)



(Fig. No.155 View of barge carrying coal along National Waterways -1)

Uttar Pradesh is endowed with various industries that might have come up based on the availability of the minerals and number of power plants that have been planned to be set up in the Vindhya region, the coal demand with MMT Varanasi will be always be at high, through which considerable amount of coal aggregates may transported in the region through IWT routes along National Waterways-1

As coal is used as raw fuel to many other establishments in the region, Mirzapur district having considerable amount of limestone and bauxite deposit, therefore Aluminium Plants have also to come up in the region, Sonbhadra district of Purvanchal region where Hindalco has already established the Asia largest Aluminium extraction plant.

Coal demand transportation are always high along National Waterways -1 and coal used as raw materials with several industries, therefore IWT based coal transportation becomes future preferred modes of transport.

NTPC has also planned to established several power plants along the hinterlands of Ganga in future for meeting the national demand of energy, where coal is the basic raw input for them, hence the IWT based low-cost coal supply chain supports in development of thermal power plant along the hinterland of river Ganga

For better utilization of Water, Coal and Fly Ash products along with IWT transport integration becomes vital, the development of MMT Varanasi may supports for rapid development of Power plants and cement industries in the region.

4.22 Case study on Fertilizer Transportation from Varanasi to West Bengal:

Fertilizer is the most important agricultural inputs that highly demanded along the rural agrarian society of National Waterways-1 hinterlands, the inland water transport reaches rural far-flung areas, where it provides connectivity in most interior and rural coastal basin agrarian society.

The Indian agriculture sector share in GDP is approximately 14.65 % and India's more than of 50% populations are engaged in the agriculture and allied activities. Besides the crucial transport linkages in rest economy of the rural areas, these sectors are continuous supporting for the GDP of the nation including social and nutritional benefits.¹⁴

Fertilizer is raw input for increasing agriculture production in the states of Bihar, Eastern Uttar Pradesh and West Bengal primarily. The IFFCO Phulpur plant majorly caters its production into these areas. The concentrated efforts and substantial increase in agriculture makes that region Aatma Nirbhar Bharat. Therefore, in management of low cost and efficient logistics for meeting future increasing demand of Fertilizer in the rural areas that may be transported through IWT. Inland Water Transport has an advantageous presence along the rural community where most productive lands for agriculture are available.

The IWT transport infrastructure makes possible in supporting two-way logistics for the emerging farmers along Gangetic coastal region.

As per Ministry of Chemical in our country 32 numbers of fertilizer plants are established as on date where 462.15 Lakh Metric Tonnes of fertilizer productions are recorded, and the demands are increasing with more than of 10% hence, in future very soon it gets double by 2030.

¹⁴ Business register of economics and statistics division, department of planning, Government of Uttar Pradesh

The roadways and railways modes of transport has already huge pressure and development of logistics system with railways puts additional cost on Indian economy. In such situations the development of Inland Water Transport become viable alternative options.

The MMT Varanasi location is strategically suited for cargo aggregations and further distributions, the product wise and region wise the distributions may be planned with IWT infrastructure supports.

The demand of fertilizer is also in Nepal, Bhutan, Bangladesh and Myanmar, the IWT project makes presence of international trades most easily possible. India has made self-sufficiency in terms of production of fertilizer in the country, the gap of production and demand creates surplus and it may be given to the neighbouring

Transportation demand of fertilizer is available in the Varanasi region due to the presence of M/s IFFCO fertilizer manufacturing plant near Phoolpur, the interactions were done with Dispatch head of the plant regarding assessment of O-D pairs, during consultation it was revealed that M/s IFFCO has already dispatched one consignment of Fertilizer to the West Bengal through waterways to test the conditioning, further they disclose that they have also conducted the pilot study with help of M/s HPC and IWAI regarding IWT based fertiliser logistics solutions.¹⁵

The Phoolpur fertilizer plant is commissioned since 1981 where neem coated fertilizer are produced over 1.7 million tons annually, the fertilizer of Phoolpur plant is dispatched in form of bagged parcel with roadways and railways presently.

For Assessment purposed further investigations were made with the Unit Head where he has shared about the case of Phoolpur to Uluberia O-D pairs where he may thought for instantly model shift the cargo on Inland Water transport mode.

As the information was revealed during interviews the total 2 railways racks are transported weekly from plant to West Bengal and it may increase during monsoon seasons.

Under the present logistics plan rail makes up the main part of transportation from Allahabad to Howrah. The cost assessment with railways modes of transport.

Estimation of Railways Freight from Phoolpur to Howrah per MT

Market Price of Fertilizer Avg. Per Ton is approx. 5400		% of Railways Logistics Cost out of Total Market Price
Freight Charges	INR 550/MT	10.18%
First Mile	INR 160/MT	2.96%
Last Mile	INR 170/MT	3.14%
Handling Cost	INR 150/MT	2.77%
Total Freight	INR 1030/MT	19.07%

With the railways modes of transport, the total logistics cost incurred on transportation of fertilizer from Phoolpur to Howrah is approximate INR 950 that is approximately 19% of the value of market price, therefore the price to the input of fertilizer increase due to addition of logistics cost. With the railways modes of transport 2 days of time required and it also affect railways traffic.

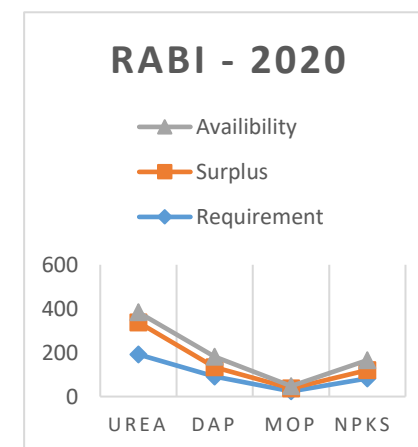
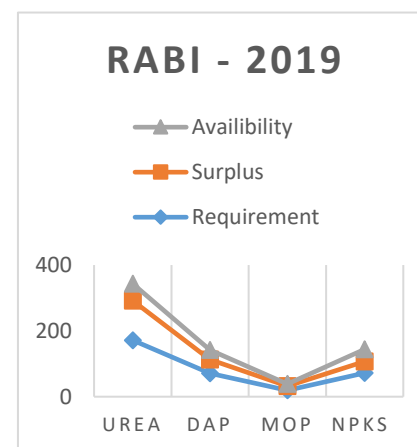
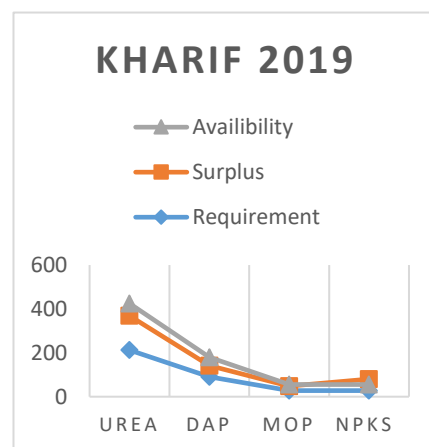
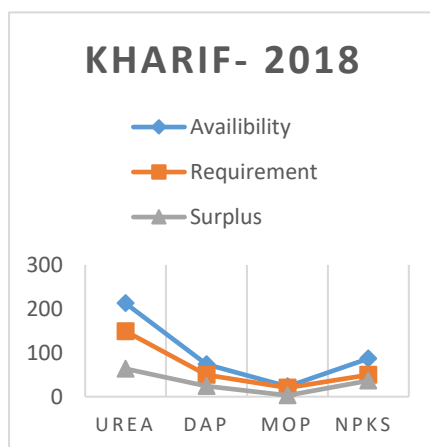
¹⁵ PIB News of 25-October-2016, released by Ministry of Shipping for Development of National Waterway -1 Driving Economic Benefits and Employment Opportunities in Uttar Pradesh, Bihar, Jharkhand and West Bengal

The efforts of IWT at Varanasi may offers IFFCO Phoolpur Plant to present their balanced logistics operational follows of stock transfer with help of IWT sector. Some plans may require for development of logistics infrastructure with minimal intended possible times.

Comparison of requirement, Availability and Surplus of fertilizer qty in India												
Year	Kharif in Lakh Metric Tonnes						Rabi in Lakh Metric Tonnes					
	2018			2019			2019			2020		
Productus	Availability	Requirement	Surplus	Availability	Requirement	Surplus	Availability	Requirement	Surplus	Availability	Requirement	Surplus
Urea	212.43	148.9	63.53	212.38	156.22	56.16	171.6	120.28	51.32	191.72	146.07	45.65
DAP	73.35	49.18	24.17	89.77	51.22	38.55	70.97	41.65	29.32	90.53	43.24	47.29
MOP	23.18	20.25	2.93	27.73	20.39	7.34	19.23	12.99	6.24	23.81	13.28	10.53
NPKS	86.49	49.73	36.76	27.73	52.97	-25.24	72.06	35.17	36.89	82.97	36.92	46.05
Total	395.45	268.06	127.39	357.61	280.8	76.81	333.86	210.09	123.77	389.03	239.51	149.52

Source: Annual Report 2019-2020 of Ministry of Chemicals and Fertilizers Department of Fertilizers, Governmnet of India

(Table No.25, Fig No.156, Details of Crop Pattern & Fertilizer Supply in India)



For M/s IFFCO the Varanasi MMT will be the entry port and GR Jetty will be the exit port for transportation of fertilizer along NW-1, there is internment advantages of intermediate ports that may be used for discharge of cargo and helps M/s IFFCO for their distribution and market expansion.

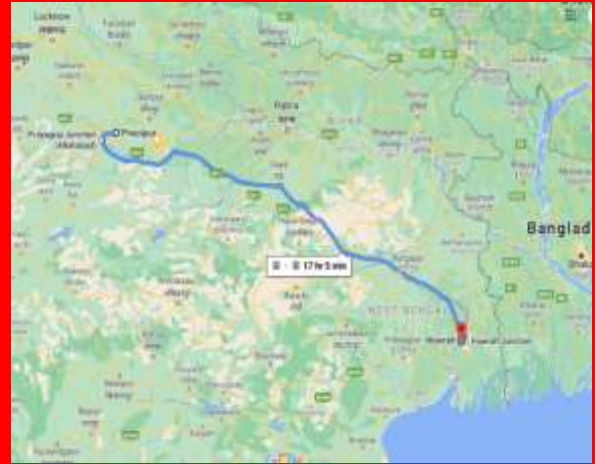
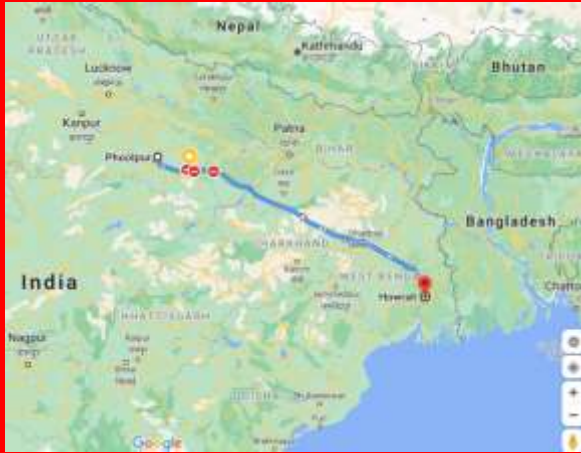
The logistics arrangement with Inland Water Transport following will be the applicable distances and cost parameters may to be considered.

Estimation of IWT freight for model shift fertilizer cargo on IWT routes along NW-1		
Estimated IWT Distance	1230 Km	Containers used for fertilizer transport that increase the efficiency of logistics handling at Ports.
Loading Port	MMT Varanasi	
Unloading Port	Gr Jetty	
Origin of cargo	Phoolpur Plant, Uttar Pradesh	<i>Calculation of Percentage of IWT Logistics cost out of Market Price of fertilizer (INR 5400)</i>
Destination of cargo	Uluberia, West Bengal	
First Mile Cost and handling at MMT Varanasi	INR 350/MT	6.48%
Waterways Freight	INR 250/MT	4.62%
Last Mile Transport cost and handling at Gr Jetty	INR 375/MT	6.94%
Total cost	INR 975/MT	18.05%

(Table No.26 Estimation of IWT freight for model shift fertilizer cargo on IWT routes along NW-1)

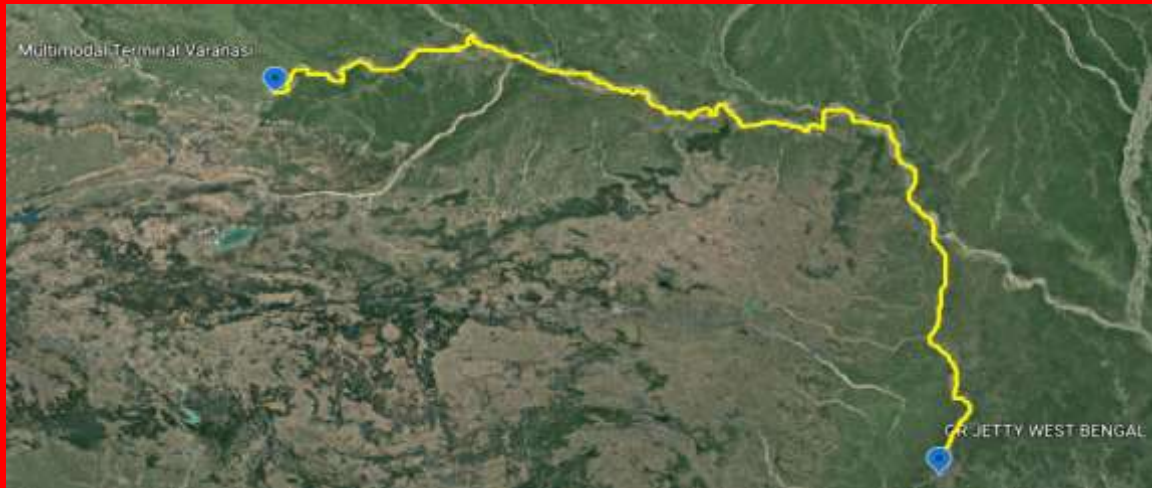
The Inland Water Transport reduces approximately 1% of logistics cost of fertilizer for transportation of cargo through IWT mode from Railways head. However M/s IFFCO is also transporting their fertilizer with roadways with current cost of 1500/MT therefore if we compare logistics with overall benefits of IWT transport that still exist with longer distance transport with full loads of 2000 Metric Tonnes of cargo.

Building upon the regular movement plans through Inland Water Transport sector provides conceptual alternative logistics solutions and aggregations of cargo along the National Waterways -1 that helps in establishing efficient supply chain and distribution channels, the IWT transport is most economically viable options for transportation of cargo as available in the country.



Indicative Route Map of Roaways Transportation

Indicative Routes Map of Railways Transport



Indicative Route Map of Inland Water Transport from MMT Varanasi, U.P to GR Jetty Kolkata, W.B

(Fig.No.157 Indicative Routes of Various Modes of Transport's)

4.23 Analysis of Data Interpretation

(Secondary Data)

4.23.1 Analysis Cargo Traffic Movements on National Waterway-1

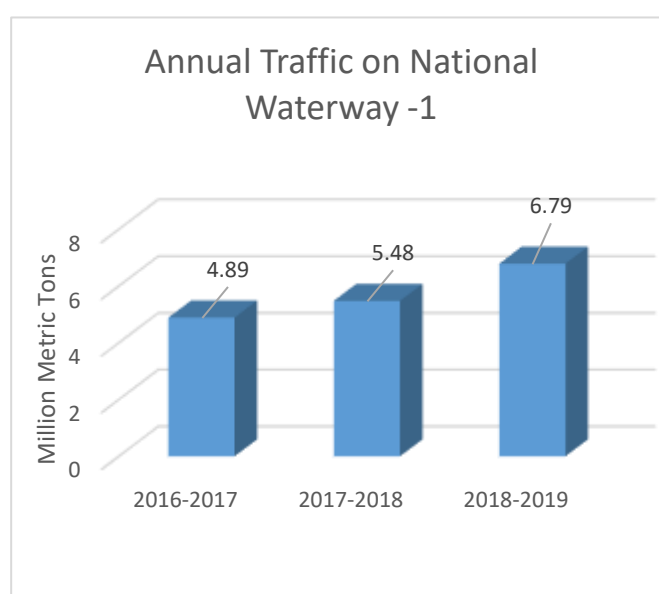
Inland Waterways Authority of India (IWAI) is putting synchronised effort to attract private sector participation and Investment to increase IWT traffic on NW-1. The implementation initiatives of Jal Marg Vikas Project has targeted to achieve the objective for creating all-weather river transportation facility which is capable of handling bulk cargo movements through IWT Mode, the dredging project on NW-1 will ensure for sufficient LAD availability and facilitate navigation for 1500 to 2000 DWT barges on NW-1 by FY 2023.

Rising trend of traffic movement along National Waterway - 1

The implementation of Jal Marg Vikas Project has started reflecting positively inclined graph of traffic movement along NW-1 since FY 2016-2017 onwards.

The traffic data for FY 2017-2018 shows that there are increases in 12% of cargo traffic movement on NW-1 as compared to FY 2016-2017.

Similarly, FY 2018-2019 reflects an increase in 23% of Cargo traffic movement is recorded as compared to FY 2017-2018.



In the current FY 2019-2020 up to December the total cargo volume of 5.05 million metric tons are already moved on NW-1 and expecting for rising the bars of traffic movement on NW-1 this FY also.

IWT mode has diverted movement of cargo from existing modes of transport i.e Roadways and Railways. The freight movement along the National Waterways -1, significantly saves emission of Co2, since FY 2016 onwards up to till date the total savings in emission of Co2 is derived as 1635968.6 tons.

Financial Year	Yearly Traffic Moved on NW-1 (In MMT)	% increase of annual traffic over previous FY	Savings in Co2 emission (Ton)
2016-2017	4.89	-	250964.58
2017-2018	5.48	12%	281244.56
2018-2019	6.79	23%	348476.38
2019-2020 (* Up to Dec month)	5.05	-	258662.88
Total	22.21		1635968.6

(Table No. 27 & Fig. no. 158)

¹⁶ Archive portal of Government of India, by National Informatics Centre (NIC)
Web Link: <https://archive.india.gov.in/sectors/transport/index.php?id=23>

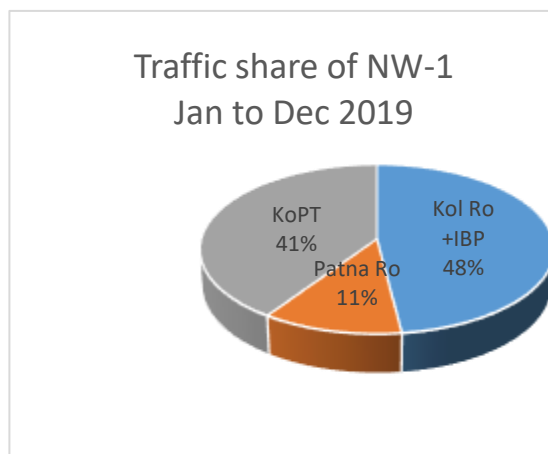
4.23.2 National Waterways – 1 Traffic Mix Analysis (January – December 2019)

The total IWT traffic moved on NW-1 from Jan 2019 to Dec 2019 was 7.24 million metric tons that of including of traffic data received from Patna Ro, Kolkata Ro, and KoPT.

Majorly the traffic data of NW-1 is measured by counting for vessel/traffic movement along three regions i.e Patna Ro, Kolkata Ro, and KoPT.

Traffic Movement	Kolkata Ro. + IBP	Patna Ro.	KoPT	Total Traffic
Metric Tons	34,79,435	8,29,781	29,37,998	7247214
% share of Traffic	48 %	11 %	41 %	100 %

* Traffic of KoPT = (Total Traffic – Kolkata and Patna Ro Traffic)



(Fig.No. 159 & Table No.28)

Out of 100% of NW-1 traffic, IBP routes move the share of 48% of IWT traffic, the Patna regions move 11% of IWT traffic and Kolkata Port Trust manages to move the 41% of IWT traffic of National Waterways - 1

4.23.3 Month Wise Analysis of Cargo Traffic Movement along NW-1 Jan – Dec 2019

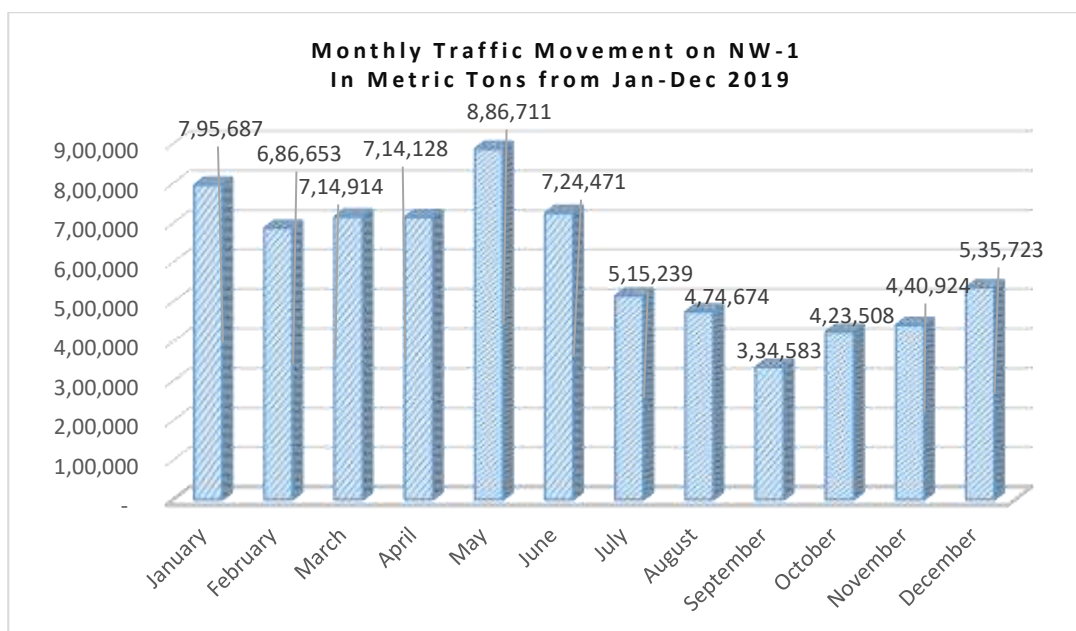
The table given below reflects there is year around traffic movement on National Waterway 1 since Jan to Dec 2019, tabular data displays there is a regular cargo movement and January 2019 has recorded the highest freight movement on NW-1 for the last 12 months of the year 2019. Below table indicates that Ro-Ro traffic the movement was in 8 months only, whereas ODC traffic movement appears for 3 months in the past year.

In 2019 three pilot movements were conducted out of which 2 pilot movements have carried cargo loads of above 1000 MT on IWT barges and in the coming future the dredging project on NW-1 will ensure LAD availability and facilitate the movement of above 1500 DWT barges.

Year 2019	Cargo (MT)	Ro-Ro (MT)	ODC (MT)	Pilot Movement Details	Total Traffic in (MT)
January	7,24,327	71,360			7,95,687
February	6,31,889	54,764		Container Movement 16 TEUs (Varanasi to Kolkata)	6,86,653
March	6,40,994	73,920		Stone Chips Movement (Farakka to Narayanganj) approx. 1023 MT	7,14,914
April	5,60,658	1,53,360	110		7,14,128
May	6,51,071	2,34,590			8,86,711
June	5,29,271	1,95,200			7,24,471
July	4,96,089	19,150		M/s Adani 52 (Haldia – Sahibganj – Patna) Container movement	5,15,239
August	4,73,374	-			4,74,674
September	3,34,583	-			3,34,583
October	4,23,508	-			4,23,508
November	4,40,437	-	487		4,40,924
December	5,16,436	18,000	1,287		5,35,723
Total	64,22,637	8,20,344	1,884		72,47,214

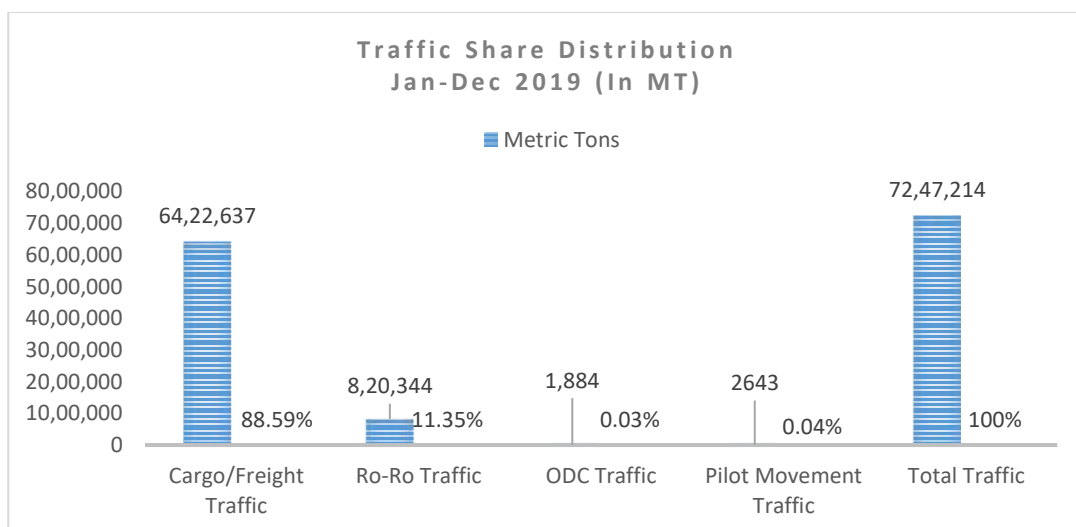
(Table No. 29)

4.23.4 Graphical analysis - Month wise traffic movement on National Waterways 1 (Jan – Dec 2019)



(Fig No. 160)

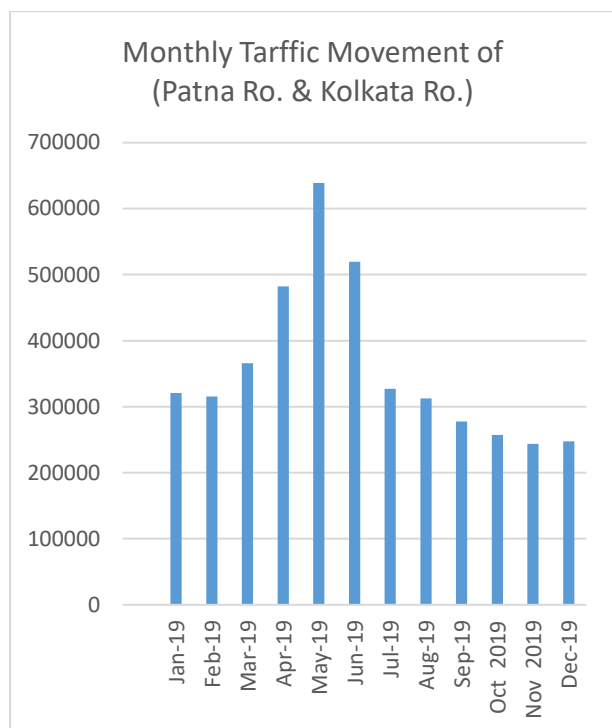
May 2019 has recorded highest traffic movement along NW-1 from Jan – Dec 2019



(Fig. No.161 Yearly Traffic Share Distribution along NW-1)

Since from Jan to Dec 2019 the total traffic moved on NW1 is 7.24 million metric tons out of which the cargo/freight traffic was of 88.59% and Ro-Ro traffic was accounted for 11.35%, whereas the ODC and Pilot movement has minimal traffic share of 0.03% & 0.04% respectively.

4.23.5 Month Wise Traffic Movement Statement of Patna Ro & Kolkata Ro Jan – Dec 2019¹⁷



Month's	Patna Ro Cargo Volume (MT)	Kolkata Ro+IBP Cargo Volume (MT)	Total Cumulative Ton-km (Patna+Kol)	Total Cumulative Cargo Volume (MT)
Jan-19	71360	249327.35	201317483	320687
Feb-19	54764	260889.599	209375973	315654
Mar-19	73920	291994.22	230195708	365914
Apr-19	153470	328657.52	267327852	482128
May-19	235640	403071.96	325045990	638712
Jun-19	195200	324271.428	261507340	519471
Jul-19	22000	305238.661	242818072	327239
Aug-19	1300	311374	255173869	312674
Sep-19	0	277583	228518299	277583
Oct 2019	0	257507.95	211008151	257508
Nov 2019	487	243437	195746638	243924
Dec-19	21640	226083	184637899	247723
Total	829781	3479435	2812673274	4309217

(Fig No. 162 & Table No.29)

4.23.6 Vessel Movement at Farakka Navigational Lock Gate

Financial Year	Yearly total number of vessels crossed lock gate	Yearly number of vessels crossed lock gate from D/S to U/S	Yearly number of vessels crossed lock gate from U/S to D/s	Total GRT of the vessels crossed lock gates
Jan – Dec 2018	228	124	104	77001
Jan – Dec 2019	230	124	106	96122

*analysis done as per the traffic data provided by Farakka office.

***Total GRT of vessels crossed Farakka lock gate Increases by 24% since Jan-Dec 2019 over previous calendar year i.e 2018**

In the above table total, GRT was increased by 24.83% compared to the vessels crossed the lock gate in the previous year.

(Table No.30)

4.23.7 Number of different types of vessels crossed Farakka navigational lock gate

Financial Year	Cargo Vessel & Barges	Tourist/ Raft/ River Cruise Vessel	Motor Vessel	Country Boat	Pontoon, Survey Launch Tug & Dredgers	FRP Boat, House Boat, Fishing Boat	Total Vessel Crossed
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¹⁷ Ministry of Shipping, Govt. of India, Web link: <http://shipmin.gov.in/>

						& Others Vessels	
Jan-Dec 2018	50	23	23	40	83	9	228
Jan- Dec 2019	72	16	28	29	76	9	230
<i>*Movement of Cargo Vessel & Barges from Jan-Dec 2019 was increased by 44% over previous calendar year i.e 2018</i>							

(Table No.31)

The above table, arrangements show different types & numbers of the IWT vessels crosses Farakka Navigational Lock gate in past two calendar year i.e 2018 & 2019

4.23.8 Month wise statement of IWT traffic at Farakka Navigational Lock Gate for 2018 & 2019

Monthly Traffic	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Jan-Dec 2018	19	19	14	4	12	17	18	22	14	35	28	26	228
Jan-Dec 2019	22	18	22	19	19	9	28	14	4	22	23	30	230

The above table shows month wise number of IWT vessel crossed Farakka navigational lock gate in the last two calendar years.

(Table No.32)

4.24 ANALYSIS OF PILOT MOVEMENT (Table No. 28)

Out of 18 pilot movements, eight pilot voyages were conducted in upstream directions, seven pilot voyages were conducted in downstream directions and three pilot voyages conducted from NW-1 to IBP routes for testing National Waterways – 1

Total 11,284 Km of distance was covered by the IWT vessel for conducting 18 pilot runs on NW-1

IWAI has transported total 16,743 metric tons of cargo quantity through 18 pilot runs and tested various O-D pairs along NW 1, during the execution of pilot movement total 52% of cargo quantity was transported in upstream directions, 17 % of cargo quantity was transported in downstream directions and 32% of cargo the quantity was transported from NW-1 to IBP routes.

Out of 18 pilot movements, five pilot movements have shipped cargo load of above 2000 MT, three pilot movements have shipped the cargo load of above 1000 MT and 10 pilot movement have shipped the cargo load of less than 500 MT to test various conditioning of river

Three pilot voyages of above 2000 MT were conducted in upstream directions and two pilot voyages conducted from NW-1 to IBP routes.

One pilot voyage of above 1000 MT was conducted for each direction i.e upstream, downstream and from NW-1 to IBP routes respectively.

Four pilot voyage of less than 500 MT were transported in upstream directions and six pilot voyage was conducted in downstream directions.

4.24.1 Pilot Movement Tabular Analysis - 1

Pilot Movement	No. of Pilot Voyage	Pilot Voyage In Kilometres	Cargo Qty. Moved In Metric Tons	% share of Cargo Qty. Moved	No. Pilot Voyage Less than 500 MT	No. Pilot Voyage of 1000 MT & Above	No. Pilot Voyage of 2000 MT & Above

Upstream Voyage	8	4172 Km	8775	52%	4 Voyage	1 Voyage	3 Voyage
Downstream Voyage	7	4432 Km	2840	17%	6 Voyage	1 Voyage	-
NW-1 to IBP routes	3	2680 Km	5128	32%	-	1 Voyage	2 Voyage
Total	18	11284 Km	16743	100%	10 Voyage	3 Voyage	5 Voyage

(Table No.33)

Total seven different types of cargo types were transported through 18 pilot movements out of which 2 voyages were conducted for Fly ash, 3 voyages were conducted for Food Grains, 5 voyages were conducted for Containers & Cement and 1 voyage of each were conducted for Timber logs, stone chips, and silica sand, etc.

4.24.2 Pilot Movement Tabular Analysis – 2

Cargo Types	Fly Ash	Timber Logs	Food Grains	Containers	Cement	Stone Chips	Silica Sand	Total
Qty. Moved Through Pilot Voyage (In Metric Tons)	4105	2000	4525	2580 (Approx.) (112 TEUs + 4 FEUs equivalent to 120 TEUs)	1310	1023	1200	16743
Nos. of Pilot Voyage Conducted	2	1	3	5	5	1	1	18

(Table No. 34)

Through pilot movement voyage Fly Ash and Stone Chips are mainly transported from NW1 to IBP routes.

Pilot movement voyage in upstream directions have shipped one voyage for timber logs, two voyages for food grains, three voyages for containers, and two voyages for the cement to test up-stream conditions of NW1

Pilot movement voyage in downstream directions has shipped two voyages for containers, three voyages for cement and one voyage for food grains and silica sand to test the downstream conditions of NW1

4.24.3 Pilot Movement Tabular Analysis – 3

Pilot Movement	Fly Ash	Timber Logs	Food Grains	Containers	Cement	Stone Chips	Silica Sand	Total
No. of Pilot Voyage in Upstream	-	1	2	3	2	-	-	8
No. of Pilot Voyage in Downstream	-	-	1	2	3	-	1	7
No. of Pilot Voyage from NW-1 to IBP	2	-	-	-	-	1	-	3
Total Pilot Voyage	2	1	3	5	5	1	1	18

(Table No. 35)

18 pilot voyages has demonstrated efficiency of IWT sector by transporting following different types of cargo on NW1:

Cargo Types	Volume
Fly Ash	4105 Metric Tons
Timber Logs	2000 Metric Tons
Food Grains	4525 Metric Tons
Cement	1310 Metric Tons
Stone Chips	1023 Metric Tons
Silica Sand	1200 Metric Tons
Containers	120 TEU's (Equals to 2580 MT Approx.)

4.24.4 Eighteen Pilot Movements Tested National Waterways - 1

Pilot Movement of Fly Ash:

- Pilot Movement No 7th - 2005 MT of Fly Ash was transported from Gr Jetty to Natayanganj, Bangladesh
- Pilot Movement No. 10th - 2100 MT of Fly Ash was transported from Gr Jetty to Mongla

Pilot Movement of Timber Logs:

- Pilot Movement No 6th - 2000 MT of Timber Logs was transported through IWT Vessel from Diamond Harbour to Kidderpore.

Pilot Movement of Food Grains:

- 8th Pilot Movement - Transportation of 2000 MT of Yellow Peas from Sagar Island to Kolkata
- 9th Pilot Movement - Transportation of 2225 MT of Yellow Peas from Diamond Harbour to Kolkata Port Trust
- 12th Pilot Movement - Transportation of 300 MT of Bagged Broken Rice from Bandel (Tribeni) to Falta (Bangladesh)

Pilot Movement of Containers:

- 11th Pilot Movement – Transportation of 16 TEUs containers from Kolkata to Patna
- 14th Pilot Movement – Transportation of 16 TEUs Containers from GR Jetty to Varanasi
- 15th Pilot Movement – Transportation of 16 TEUs of containers from Varanasi to GR Jetty
- 16th Pilot Movement – Transportation of 16 TEUs of containers from Varanasi to Kolkata
- 18th Pilot Movement – Transportation of 52 Containers (48 TEU,s + 4 FEU,s) from Haldia – Sahibganj – Patna

Pilot Movement of Cement:

- 1st Pilot Movement – 370 MT of Bagged Cement of Dalmia Bharat was transported from Haldia to Patna
- 2nd Pilot Movement – 200 MT of Ultratech Cement was transported from Patna to Bhagalpur
- 3rd Pilot Movement – 240 MT of Dalmia Bharat Cement was transported from Kolaghat to Bhagalpur

- 4th Pilot Movement – 200 MT of Ultratech Cement was transported from Patna to Bhagalpur
- 5th Pilot Movement – 300 MT of Dalmia Bharat Cement was transported Kahalgaon to Kolaghat

Pilot Movement of Stone Chips:

- 17th Pilot Movement – Transportation of 1023 MT of Stone Chips from Farakka to Narayangaj

Pilot Movement of Silica Sand:

- 13th Pilot Movement – 1200 MT of Silica Sand transported from Rajmahal, Sahabganj to GR Jetty, Kolkata

4.24.5 Analysis of Average Vessels Size Moved on National Waterway 1 (Table 36)

Tapping of the traffic data and finding out the average size of the vessels moved on the stretches of National Waterway -1 in last two years on the basis of GRT available in reported Traffic data.

Diverse size vessels (In GRT) has crossed at Farakka Navigational Lock Gate in last two the calendar year 2018 & 2019.

Year	Vessels having GRT less than 100	Vessel having GRT in between 100-500	Vessel having GRT in between 500-1000	Vessel having GRT in between 1000-1500	Vessel having GRT above 1500	Tugs, Dredgers, Survey Launch, Country Boats & Others (GRT – NA)	Total Vessel Crossed Farakka Lock Gate
2018	66 Vessel trips	61 Vessel trips	34 Vessel trips	23 Vessel trips	2 Vessel trips	42 Vessel trips	228 Vessel trips
2019	72 Vessel trips	46 Vessel trips	26 Vessel trips	42 Vessel trips	4 Vessel trips	40 Vessel trips	230 Vessel trips

**here vessel trips means the number of times has vessel the crossed lock gate.*

Findings:

Overall traffic at Farakka navigational lock gate was increased in the year 2019 from Jan-Dec reflections from the calendar year analysis of data, whereas movement of vessels having GRT in between 1000-1500 DWT is increased by 82% this imitates that there is an increase in the movement of vessels size of above 1000 DWT in the year 2019 over the previous year.

Diverse Size of Vessels (In GRT) Traffic Movement Inward & Outward recorded by Kolkata regional office (Traffic data extracted with help of IT cell IWAI Noida)

Kolkata Ro Traffic Movement Jan-Dec 2018	Movement of vessel having GRT in between 0 to 500	Movement of vessel having GRT in between 500-1000	Movement of Vessels having GRT in between 1000-1500	Movement of vessel having GRT above 1500	Total Movement
Inward Traffic	3302 Voyages	442 Voyages	-	-	3744 Voyages
Outward Traffic	3202 Voyages	440 Voyages	40 Voyages	7 Voyages	3689 Voyages

Kolkata Ro Traffic Movement Jan-Dec 2019	Movement of vessel having GRT in	Movement of vessel having GRT in between 500-1000	Movement of Vessels having GRT in between 1000-1500	Movement of vessel having GRT above 1500	Total Movement
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	between 0 to 500				
Inward Traffic	3134 Voyages	661 Voyages	4 Voyages	1 Voyage	3800 Voyages
Outward Traffic	3066 Voyages	645 Voyages	61 Voyages	17 Voyages	3789 Voyages

4.24.6 Findings from above table:

The above data of Kolkata Ro. reflects there is an increasing trend in the traffic movement of vessel sizes in between having GRT 500-1000 DWT, overall, 48.07% of traffic was increased of the said vessel type.

Secondly for the vessel type having GRT in between 1000-1500 DWT, the overall traffic was increase by 62.5%

Thirdly for vessel type having GRT above 1500 DWT, overall traffic was increased by 77.77% over

Sl. No.	NW-1	Total Diverted Cargo from Roads and Rails (MMTPA)	Saving in CO2 emission (Ton)
1	2016-2017	4.89	250964.58
2	2017-2018	5.48	281244.56
3	2018-2019	6.79	348476.38
4	2019-2020	5.05	258662.88
Total		22.21	1635968.6

previous calendar year i.e 2018

4.24.7 Saving in CO2 emission using IWT:

Key Assumptions:

- 1 The proportion of diverted cargo between Roads and Rails is assumed as 60:40
- 2 For calculation of TKM, 50% of waterway's length has been considered
- 3 CO2 emission factor considered: Road - 0.00016 T/TKM, Rail - 0.000029T/TKM, IWT - 0.000031T/TKM

(Table No. 37)

4.25 Incorporation of Primary Data & Its Analysis

4.25 Incorporation of Primary Data Analysis & Findings:

The questionnaire was developed intended to collect primary evidence for the research which are related stakeholders of IWT, the primary survey made to understand relativity of water transport usages in economic development for Varanasi region overall.

Inland Water transport development at Varanasi benefits majority of populations living along the hinterland of river Ganga, primary survey has surely helped in understanding possibilities of traffic diversion on IWT routes and will impact the populations for utilising waterways for varied economic needs.

The water transport development in this city recorded some quantifiable tangible and non-tangible economic benefits therefore incorporation of primary data and analysis support to complete the objective of the research. however, this primary research is limited to its objective and data set and questionnaire are prepared to draw inferences of IWT economic benefits for the Varanasi city.

The study has followed scientific and systematic research methodology to address stated objective of the research problem, as the study was spread out entire Varanasi region with assessment of existing transport and developing conclusive economic benefit from IWT sector in Varanasi region, the primary set data has helped to captured all possibilities to conclude this research by mapping stakeholders survey and potential prospective users perceptions has also captured for this new mode of transport.

The regional populations at Varanasi were mostly spreads along western sides of the river i.e Chanduali, Ramnagar & Mughalsarai etc. The urban settlements of the city are mainly located along the eastern bank therefore, majority of the populations commutes to the city for meeting of their various economic needs. Regional vehicular traffic share is very high whereas, the proposed IWT transport services may offer seamless connectivity benefits.

The survey has been conducted to collect primary data, stakeholders' perceptions, observations & findings are recorded by using short questionnaire, the primary data analysed in understanding wider IWT economic benefits and findings is incorporate in the various sections of this thesis. However, primary survey analysis section is incorporated after pre-thesis viva observations, therefore maximum possible data set pertains to primary data are being summarised at one place here especially in this section, but in the entire thesis primary data references are used to draw inferences, so please we need to understand this research has used both primary data as well as secondary data to meet its objective. Thesis examiner needed to be careful in analysing and drawing inferences herewith while reading thesis sections.

However, the IWT has various tangible and non-tangible benefits too, that are reviled during focus group discussion and interview with IWT users that are incorporated in various sections of thesis. Below summarises following potential stakeholders who has contributed their valuable time and efforts for making successful recording of primary data.

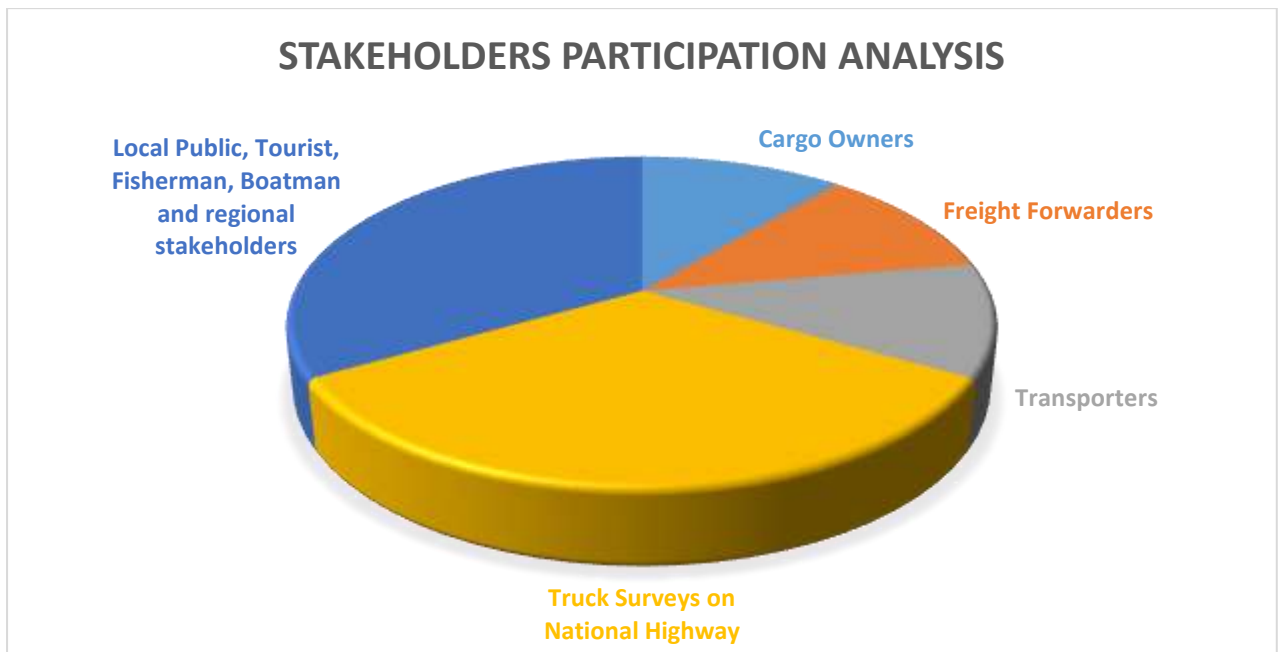
4.25.1 Primary Survey Findings No. 1

“Share of Stakeholders Participation in Collection of Primary Data for Research”

The primary data collected from the various potential stakeholders of IWT, response was recorded with help of short questionnaire during primary survey on field visit, in addition to the short questionnaire, perception & views are also captured and recorded in various sections of this thesis.

Inland Water Transport are new mode of transport for this city and transforms the urban logistics therefore, IWT has varied stakeholders that are getting complementary economic benefits.

The total 450 responses collected during primary survey where short questionnaire is being filled up to capture information from potential stakeholders of IWT i.e., cargo owners, freight forwarder, transporter, truckers survey, tourist, fisherman, boatman and local public etc.



(Figure No. 162.1 Stakeholders Participation Analysis)

The overall primary data set has 450 responses are captured from multiple potential IWT stakeholders are Varanasi, the breakup contribution of each stakeholder is important for primary research

Sr. No.	Population Type Selected for Preliminary Survey:	No. of Samples taken
1.	Cargo Owners	50
2.	Freight Forwarders	50
3	Transporters	50
4	Truck Surveys on National Highway	150
5.	Local Public, Tourist, Fisherman, Boatman and regional stakeholders	150
Total		450

(Table no. 37.1)

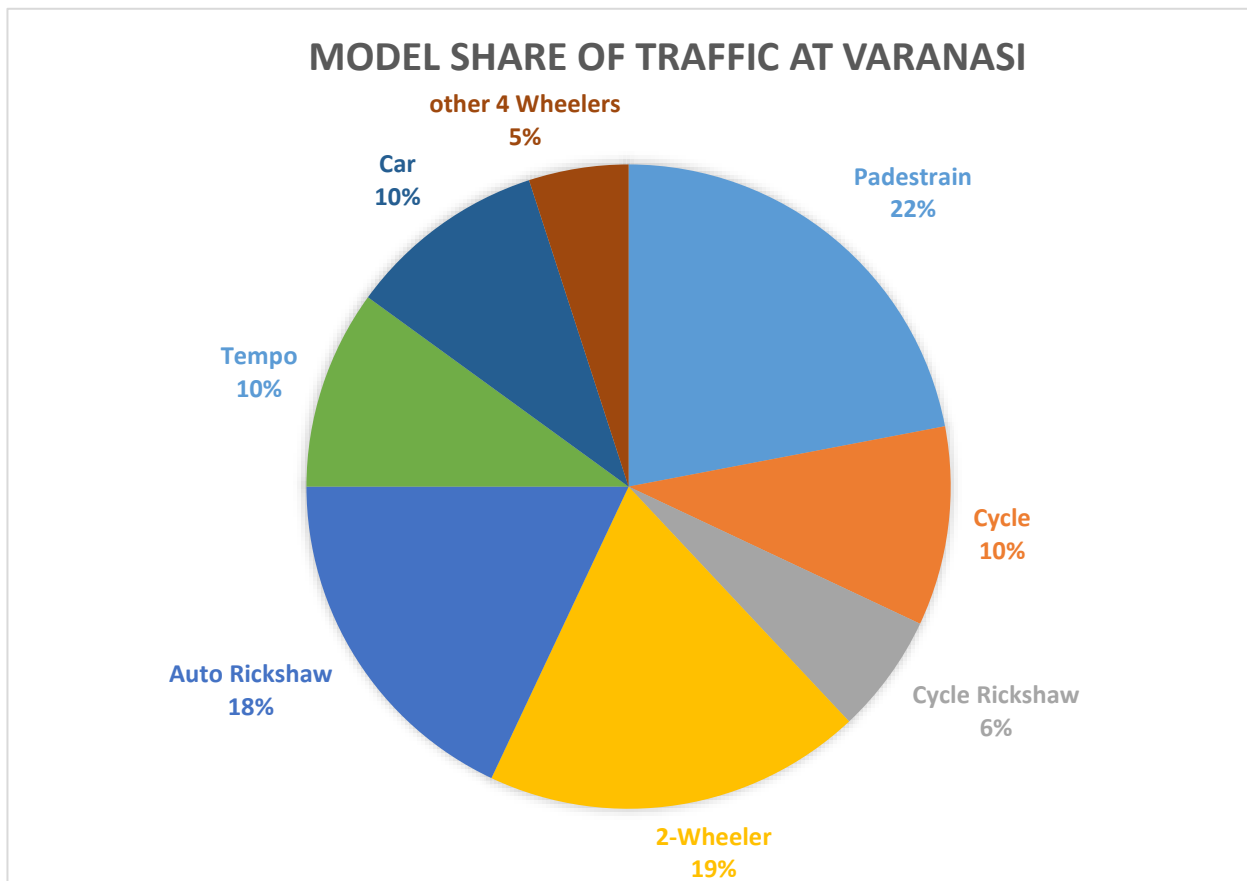
4.25.2 Primary Survey Findings No. 2

“Traffic Share of Vehicle Populations at Varanasi City”

Model traffic survey has been conducted during the study aiming to access percentage of different vehicular types are sharing the city roads, local populations commute city for meeting their economic needs through using various modes of transport.

During primary survey it was identified that in Varanasi city widely used paratransit mode of local transportation and city has lacuna of availability of any formal modes of transport system, the development of IWT ferry routes in the river Ganges will introduce first formal mode of organised transport system through Waterways.

The traffic counting survey has been conducted on major nodes of the city, especially three bridges connecting both banks of river Ganga at Varanasi, the assessment of commuters and study of local transport profile draws traffic movement patterns and commuters’ modes.



(Figure No. 162.2)

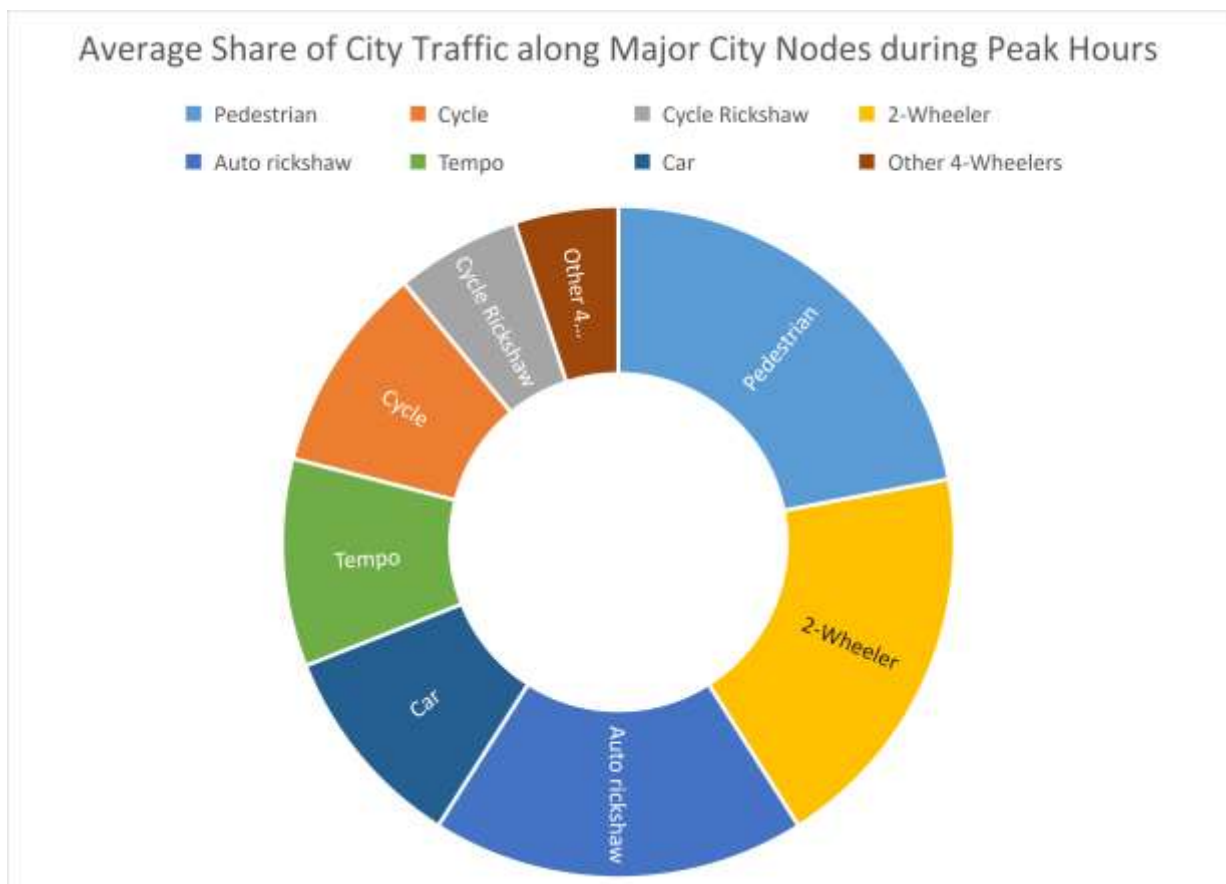
4.25.3 Primary Survey Findings No. 3

“Traffic Assessment along Major City Nodes at Varanasi”

Public transportation of Varanasi city is highly depended upon the motorized shared para-transit (temp and autos) were the predominant in nature, generally the trips were shared among the passengers travelling from one intersection to another, the populations travelled for varied reasons i.e Business, Jobs, Health, Education, Govt. official works, courts, tourism etc.

The primary investigations were conducted to identify the percentage share of the model-mix vehicle populations recorded at important traffic nodes of the city who travels across the river, ideally the survey has been conducted along the bridges available at Varanasi and major traffic junctions like. BHU crossing Lanka, Godowalia Markets, Shivala Silk business area, Padao crossing, Ramnanagr Chauraha, Tengra Mode, Shashtri Chowk, Varanasi Junction, Mughal Sarai, Kashi Station, Sonarpura, Telibagh and Rajatalab etc. these are the major traffic nodes selected for conducting traffic studies for understanding the transportation demand and economic activities supported by enhancing the logistics services.

The peak hours of traffic selected for conducting observations during Morning, afternoon & evening time at the various important intersection nodes are surveyed and access the cumulative traffic counts and understand the patterns of vehicle percentage types propel in the Kashi city.



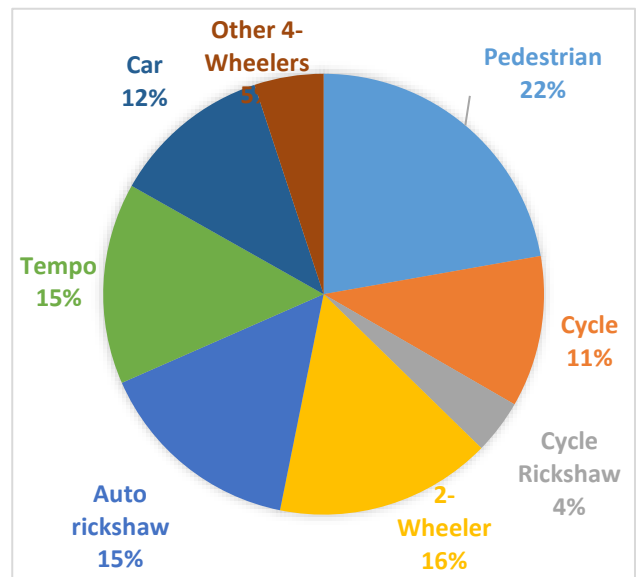
(Figure No. 162.3)

Traffic Assessment at BHU Lanka crossing:

The peak hour traffic survey conducted at BHU Lanka crossing node of Varanasi city, in primary survey findings the 22% pedestrian traffic, 16% of Two Wheeler, 15% of Auto Rickshaw, 15% of Tempo, 12% of Cars, 11% of Cycle 4% of Cycle Rickshaw and 5% of other four wheelers are found moving at this node.

BHU Lanka crossing is the busiest node of the city where regional populations move for meeting the purpose of education, healthcare needs as this node have availability of BHU world class healthcare facility and centre of education hub due to availability of Banaras Hindu University.

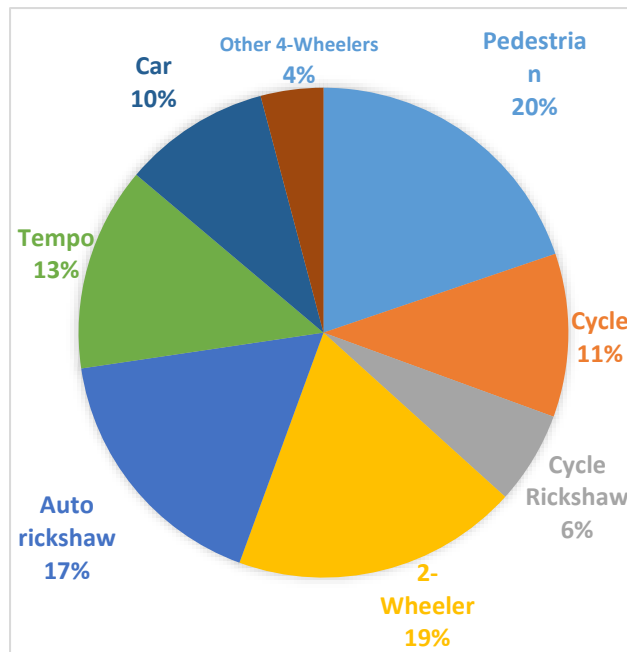
This crossing node has many tourist visitors as nearby good hotels exist here and place is convenient for darshan & aarti of pilgrimages.



Average Traffic Composition BHU Lanka

(Fig. No. 162.4)

Traffic Assessment at Godawalia Markets



Average Traffic Composition at Godawalia

(Fig. No. 162.5)

Primary traffic assessment survey was conducted at Godawalia Market during the peak hour sub-urban traffic are huge, the place is full of pedestrian, auto rickshaw, tempo, two-wheeler, bicycle and cars etc.

Godawalia Market is the oldest bazar area where presence of commercial establishment exist, this place has thousand of vendors and retail, wholesaler who market the goods. This place is nearest to the Varanasi Cant. Just 10 minutes rickshaw ride, so almost good node for marketing purposes.

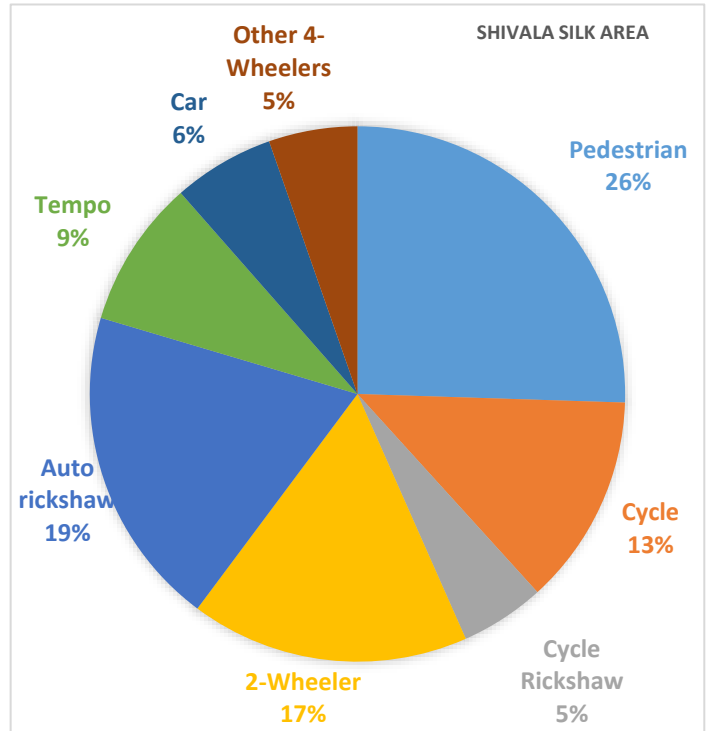
The traffic composition of 20% pedestrian, 19% of two-wheeler, 17% Auto Rickshaw, 13% of Tempo, 11% of Cycle 10% of Car, 6% of Cycle Rickshaw and 4% are for other 4 wheelers etc.

Traffic Assessment at Shivala Silk Area

Shivala Area of Varanasi is having manufacturing hub of silk saree production, Varanasi city is known throughout the world for production of very fine silk saree and Banarasi Saries. At this node majority of local population gather during sunrise for puja, aarti and taking boat rides at Shivala Ghat

The city traffic assessment at Shivala Ghat are having 26% of pedestrian, 19% of Auto Rickshaw, 17% Two-Wheeler, 13% Cycle, 9% tempo, 6% Car, 5% Cycle Rickshaw and 5% other four wheeler etc. are found moving here.

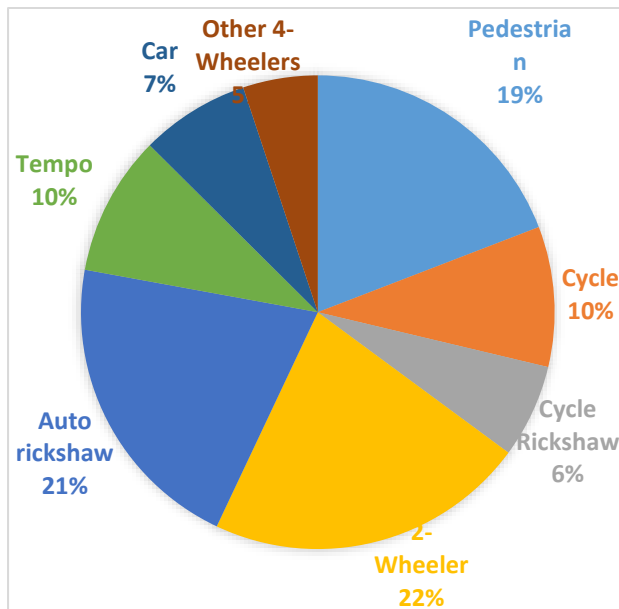
The Shivala Ghat is vibrant in evening and morning time and local public visit here to experience their leisure time along Ganga Ghat and usually takes boat rides from here, so development of IWT transport options may generate viable ridership from this point for Inland Waterways.



Average Traffic Composition at Shivala Ghat

(Fig. No. 162.6)

Traffic Assessment at Padao Crossing Area



Average Traffic Composition at Padao Crossing

(Fig. No. 162.7)

Padao is located just opposite bank of river Ganga, this place is located in the Chandauli district, the commuters from this area heavily moves towards the city on daily basis. The IWT possibilities and traffic ridership generation for ferry rides exits here at this node, this area is heavily populated and congestion are being regularly happened, this node is very important for connecting Padao to Varanasi and very nearby to the Ganga Ghat so from IWT point of view this become important to understand possibilities of shifting of traffic from exiting mode to water transport.

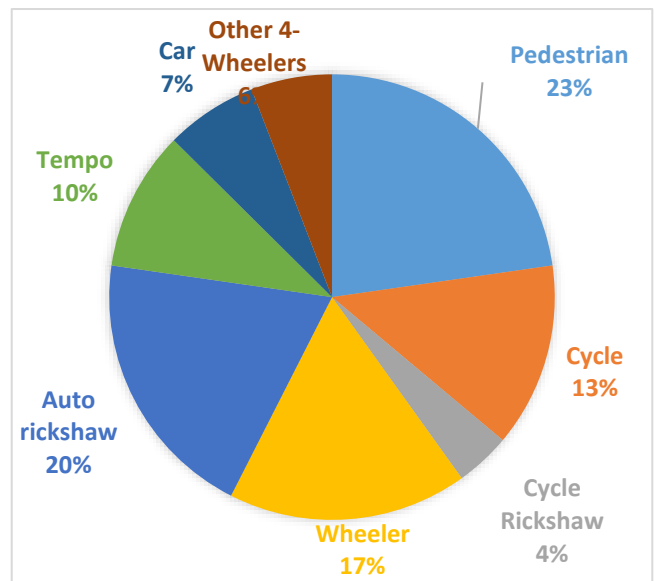
Primary traffic survey findings that place has 22% of two wheelers traffic, 21% of Autorickshaw, 19% of pedestrian, 10 % of tempo and cycle, 7% of car, 6% of cycle rickshaw, 5% of other four-wheeler etc. are moving from here.

Traffic Assessment at Ramnagar Chauraha

Ramnagar Chauraha is important node for connecting urban & rural nodes of the Varanasi region. At this point traffic movement are high so it is important to understand the traffic movement profile of this location and their usable benefit if water transport being developed from here.

Primary survey has identified this city node has 23% of pedestrian traffic, 20% of Auto Rickshaw traffic, 17% of Two-Wheeler traffic, 13% of cycle traffic, 10% of tempo traffic, 7% of car traffic, 8% of other four-wheeler traffic, 4% of cycle traffic etc.

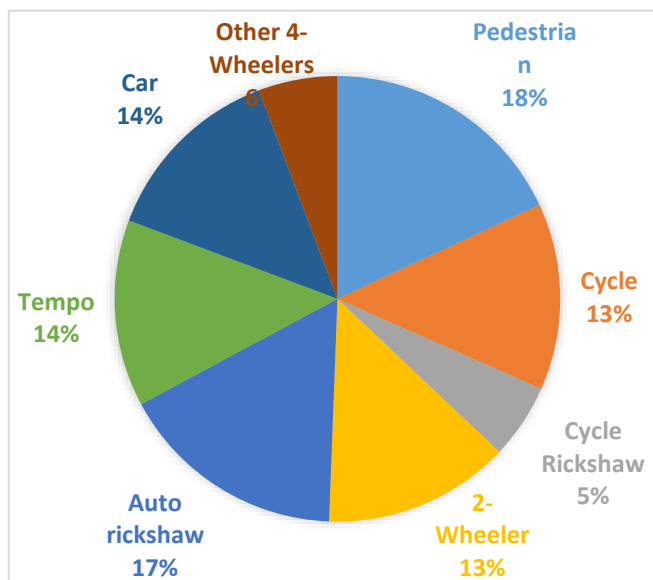
This node has sufficient number of ridership potential for upcoming Inland Water Transport system.



Average Traffic Composition at Ramnagar Chauraha

(Fig. No. 162.8)

Traffic Assessment at Tengra Mode



Average Traffic Composition at Tengra Mode

(Fig. No. 162.9)

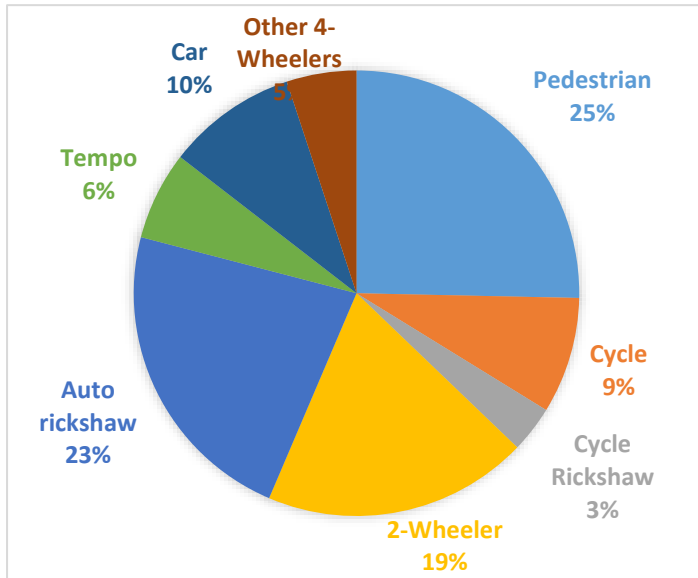
Tengra Mode is located on bypass road of the Varanasi city, this point is connecting Varanasi region with Chandauli and Sonbhadra districts, the Tengra Mode location are closet to the industrial area where population daily moves for the employment and trade purposes, from this location the MMT Varanasi an IWT terminal is about 800 meter distance and the bank of river Ganga is also closet from here, therefore traffic assessment helps in understanding ridership potential for ferry & Ro-Ro services for crossing river.

A road distance takes an hour to travel and reach to the urban core of the city, however, the waterways distance are just about takes 15 minutes to drop nearest ghats that close to the vicinity on core city are, the IWT mode will be convenient, faster, cost and time

effective mode of preposition if traveller choose inland waterways mode from here. However, in primary survey findings that this location has 18% of Pedestrian traffic, 17% of Auto rickshaw,

14% of car and tempo, 13% of two-wheeler and cycle, 6% of other four wheelers, 5% of cycle rickshaw etc.

Traffic Assessment at Shashtri Chowk

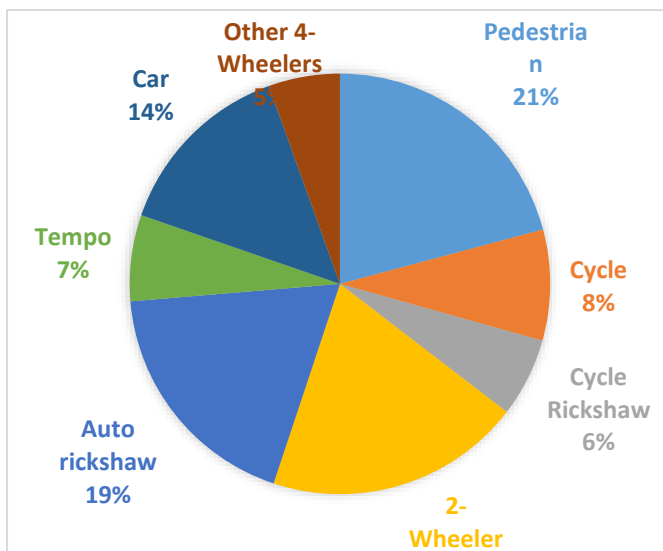


Traffic Movement at Shashtri Chowk is intermediate node for passenger movement, whomsoever from this area wanted to visit Varanasi city they passes from this node, as this area having some commercial, institutional areas with shops, colleges, hospitals and hotels of Varanasi city, so the movement of traffic observations are becoming important, this traffic may diverted through waterways. In survey it was identified 25% traffic are pedestrian, 23% Auto Rickshaw and 19 % Two-wheeler and

Average Traffic Composition at Shashtri Chowk

(Fig. No. 162.10)

Traffic Assessment at Varanasi Junction

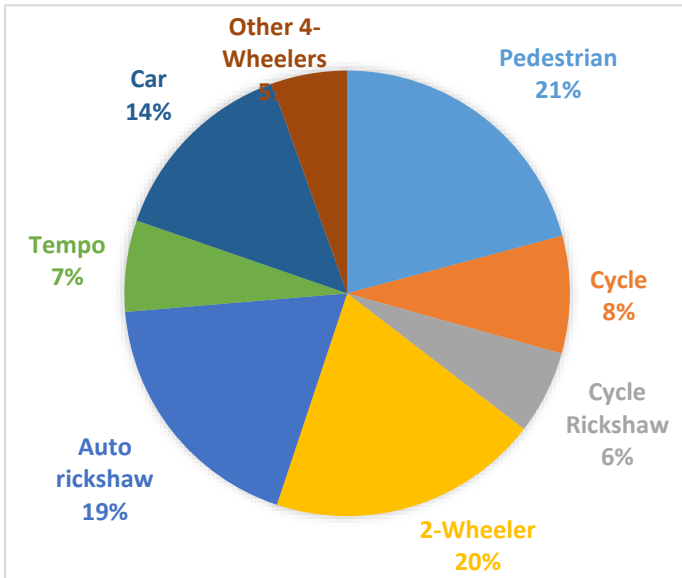


Average Traffic Composition at Varanasi Junction,
(Fig. No. 162.11)

The traffic movement at this location are dominant, being availability of railway station and interstate bus depot this area is having full of traffic movement, during interactions with local public during primary survey it was found that lot of local trips are generated from here for BHU, Kashi, Godwalia and even Mughalsarai etc. from this location water transport connectivity after development will be ideal choice for the public moving towards the Mughasarai, that may saves time, cost and reduce congestion issues up to greater extent. In primary traffic survey it was found that this node has 21% of pedestrian traffic, 20% two-wheeler, 19 auto rickshaw, 14% car, 8% cycle, 7% tempo and 6% cycle rickshaw are moving from

here.

Traffic Assessment at Mughal Sarai

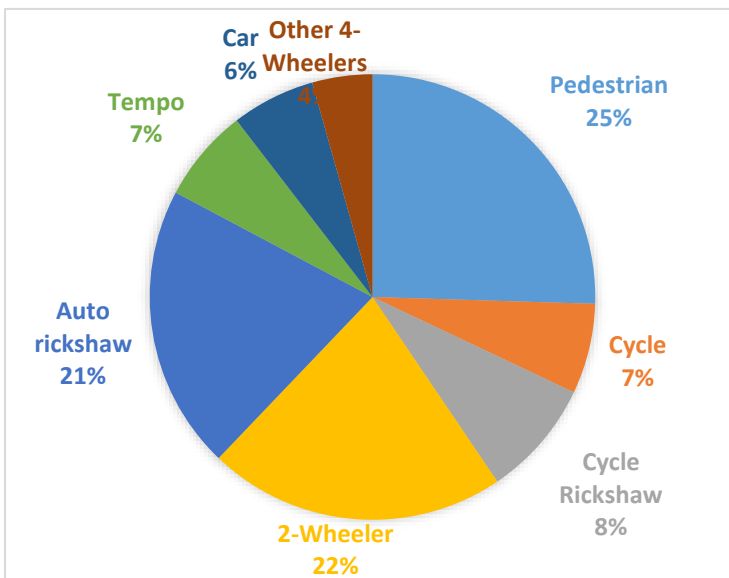


Mughal Sarai node of the city are major junction, residents of city work near Mughal Sarai so there is movement of traffic pattern are significant, the traveller visiting to Varanasi city also arrive here to take train, therefore this area is having busiest traffic, 21% of pedestrian, 19% percent are auto rickshaw, 20% are Two-wheeler, 14% are car, 8% are cycle, 7% are tempo, 6% are cycle rickshaw, 5% are other four wheelers etc. the development of IWT terminal may bring more movement here and public can easily commute to the city.

Average Traffic Composition at Mughal Sarai

(Fig. No. 162.12)

Traffic Assessment at Kashi Station

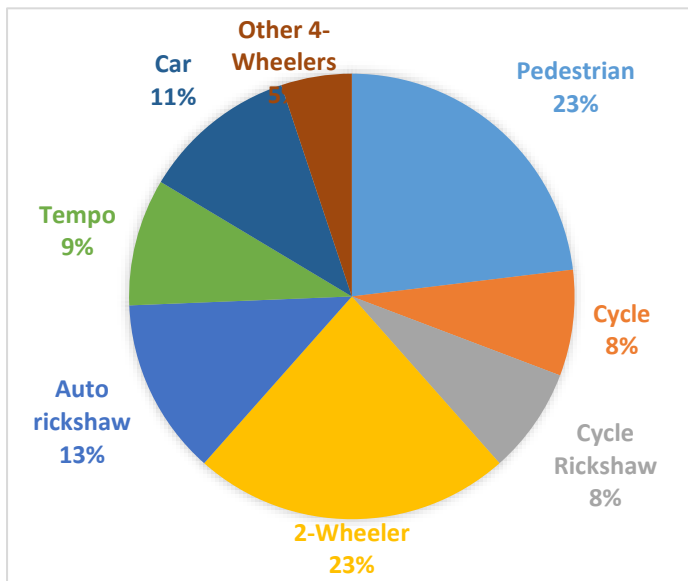


Kashi is the junction where traffic movement of passenger and tourist are always high, the railway station offers multimodal connectivity and nearby availability of Rajghat bridge nearby to Ganga offers very important node of connectivity of water transport services at busiest node, Kashi is also important node that connects Padoa, Mughalsarai in east of Sarnath, Canntt. in west and central area of Varanasi in the south, some schools, tourism attractors are also available nearby.

Average Traffic Composition at Kashi Station

(Fig. No. 162.13)

Traffic Assessment at Sonarpura

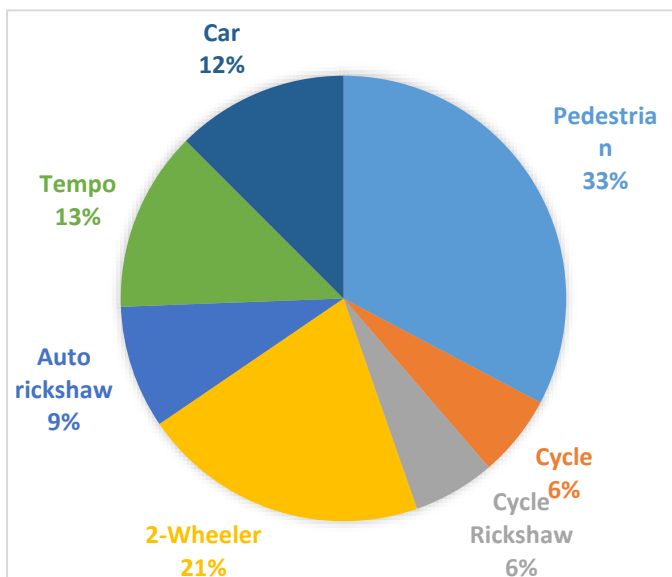


Average Traffic Composition at Sonarpura

The Sonarpura connecting node major inner city connecting node in between BHU & Godawalia, local public usually choose this route for daily commuting, the Sonarpura node provide good accesses between eastern side of the river and Cantt./Godwalia, during primary survey it was identified that 23% of Pedestrian, 23% Two-Wheeler, 13% Auto Rickshaw, 11% Car, 9% Tempo, 8% Cycle Rickshaw and 5% other four wheelers traffic are moving from here.

(Fig. No. 162.14)

Traffic Assessment at Teliabagh

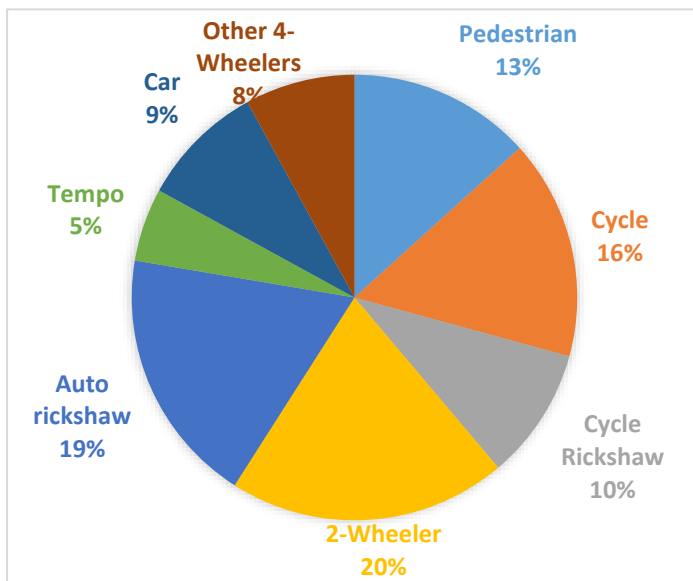


Average Traffic Composition at Teliabagh

(Fig. No. 162.15)

Teliabagh is dominant city node of traffic movement, it is an important city node for passenger who wanted to go Godawalia, Varanasi Junction of Varanasi airport. There are some commercial, institutional areas with shops, colleges, hospitals and hotels are located, hence traffic movement are usually identified significant here, in primary survey findings this location are having 33% of pedestrian traffic, 21% two-wheeler traffic, 13% tempo, 12% car, 6% cycle and cycle rickshaw and 9% auto rickshaw are moving from here.

Traffic Assessment at Raja Talab



Average Traffic Composition at Raja Talab

(Fig. No. 162.16)

Raja Talab is the rural connecting link for Varanasi city, the IWT terminal being developed at Ralhupur near Ramnagar Varanasi will offers the direct connectivity of the rural population of Varanasi to urban core of the city through development of water transport at Varanasi region, the roadways route from this location connects the city with about 25kilometers of the distance, however the IWT route will offers the city connectivity with just 5 Km of travel on waterways, therefore the rural population are living at this point are getting benefitted at large, the daily commuters of the city and farmers of the rural hinterland can easily bring their produce to the city without any difficulty with reduced transport cost and distance,

during primary survey it was identified that Rajatalab node have 20% of two wheeler traffic, 19% Auto Rickshaw Traffic, 16% Cycle Traffic, 10% Cycle Rickshaw Tarffic, 13% Padedtrian Traffic, 10% Cycle Rickshaw Traffic, 9% Car Traffic, 8% other four-wheeler traffic etc.

4.25.4 Primary Survey Findings No. 4

“Local Demand Assessment – Local Populations Reasons for Crossing of River Ganga at Varanasi”

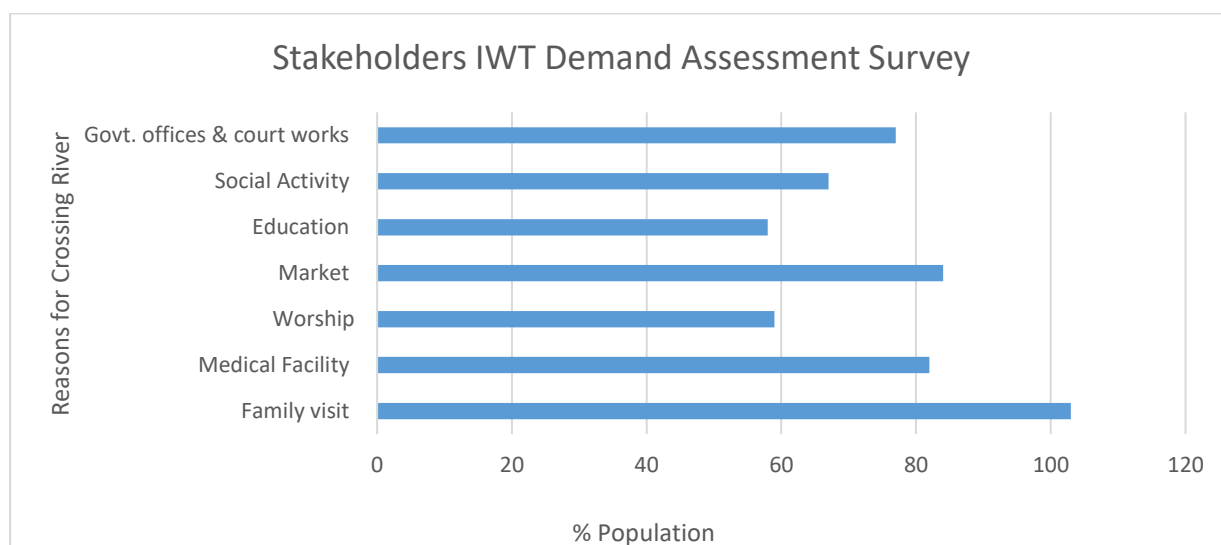
In survey it was identified that local public was agreed that communities & populations living along river Ganga have multiple reasons for crossing the river, therefore it was important to know grassroots reasons to understand that how Inland Water Transport System will benefit to the stakeholders at Varanasi

The Varanasi city is located on western bank where all urban facilities are already developed and most of social –infrastructure are already developed such as Healthcare facility, university/colleges, religious institutions, employment possibilities, marketplace for trading of goods and services, court and government offices etc.

Therefore, it is clearly indicated that development of Water Borne Transport project at Varanasi will reduce the geographical divide and enabled and sustained water transport facility, provides seamless and reliable connectivity options to the regional populations.

Presently three bridges are developed at Varanasi over river Ganga, but increasing demand of city and rising vehicular populations are creating many problems such as congestion, air pollutions, longer time taken for travelling shorter distance and other traffic issues etc.

The 150 sample interview was conducted along the Ghats of river Ganga at Varanasi, the main aim of survey was to figure out the social demand aspects related to the Inland Water Transport.



(Fig. No. 162.17)

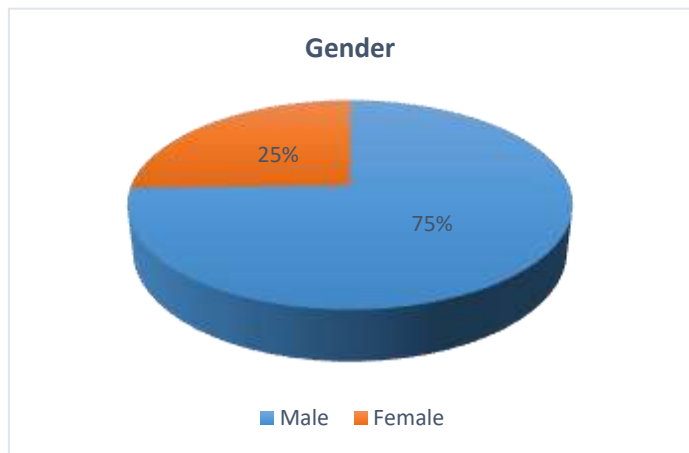
Reasons	Family visit	Medical Facility	Worship	Market	Education	Social Activity	Govt. offices & court works
% Response	69%	56%	39%	56%	39%	45%	51%

(Table No. 37.2)

4.25.5 Primary Survey Findings No. 5

“Stakeholders Demographic Assessment – Gender Participation of Sample Population”

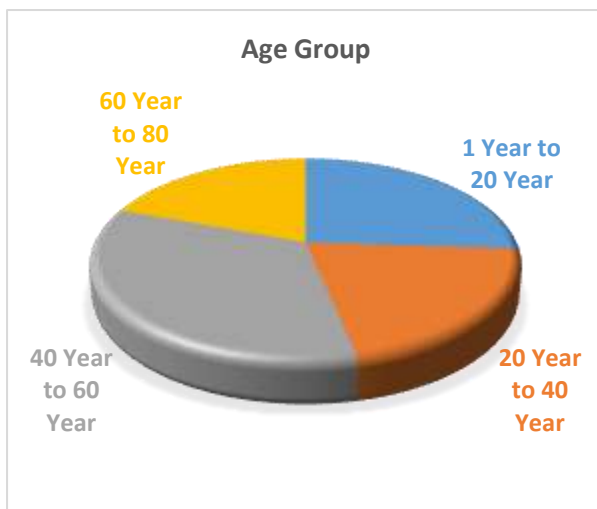
The sample response from 150 prospective stakeholders IWT user has been collected during primary survey, the demographically 75% of Male and 25% of female populations have taken part in the survey, during assessment it was identified that female populations participation in the survey was less compared to Men.



(Fig. No. 162.18)

4.25.6 Primary Survey Findings No. 6

“Stakeholders Demographic Assessment –Age Group of Sample Participated”



In Survey the participation from all type of age group has been ensured, so that experience regarding Inland Water Transport should captured more accurately from all type of age group of sample population, in primary research it will be more important to ensure multiple age group stakeholders’ participation that helps in reaching more accurate and closer finding of research.

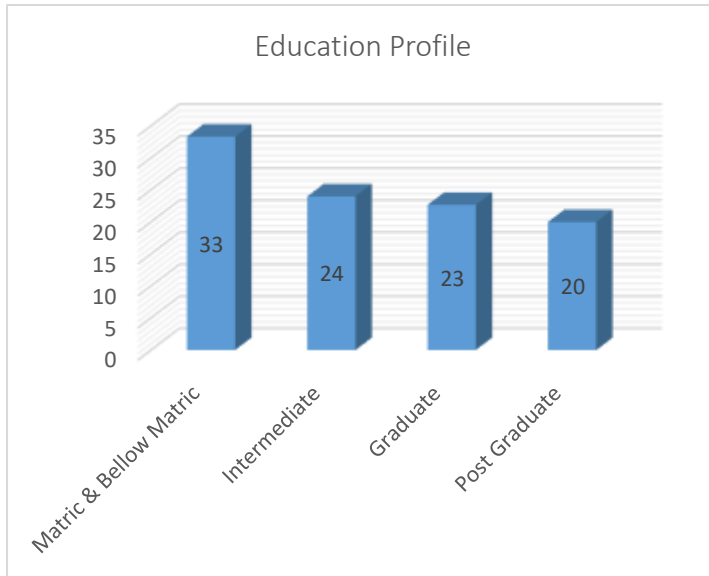
(Fig. No. 162.19)

Age Group	1 Year to 20 Year	20 Year to 40 Year	40 Year to 60 Year	60 Year to 80 Year
% Participation	26 %	21 %	34 %	19 %

(Table No. 37.3)

4.25.7 Primary Survey Findings No. 7

Stakeholders Demographic Assessment – Education Profile of Respondent:



Primary data was collected under sample frame identified within the geography of Varanasi Ghats, it was ensured that response from all types of prospective user to be collected, during random sample survey along the Ghats of river Ganga, the data related to the education profile were captured to understand education level of respondent and of each segment of society. Therefore, the graph and table bellow represent sample population have model mix type of demographic segments given their responses for this research.

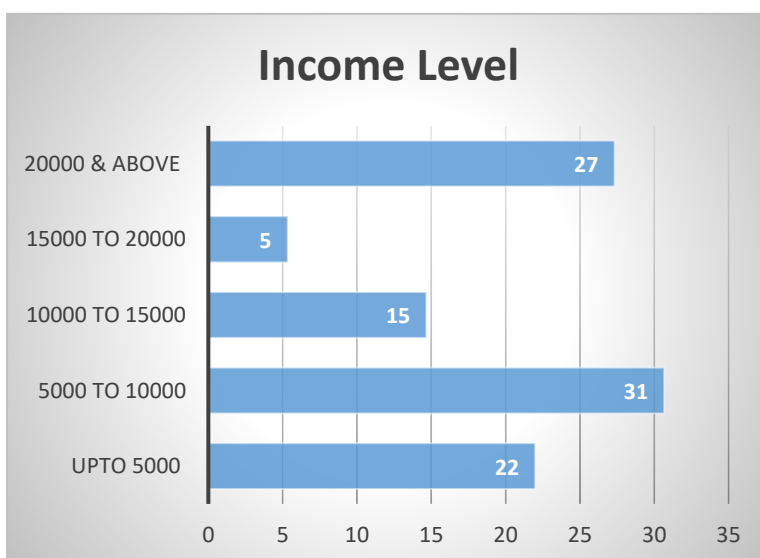
(Fig No. 162.20)

Qualification level of Respondent	Matric & Bellow	Intermediate	Graduate	Post Graduate
% Population	33%	24%	23%	20%

(Table No. 37.4)

4.25.8 Primary Survey Findings No. 8

Stakeholders Demographic Assessment – Income Level of Respondent:



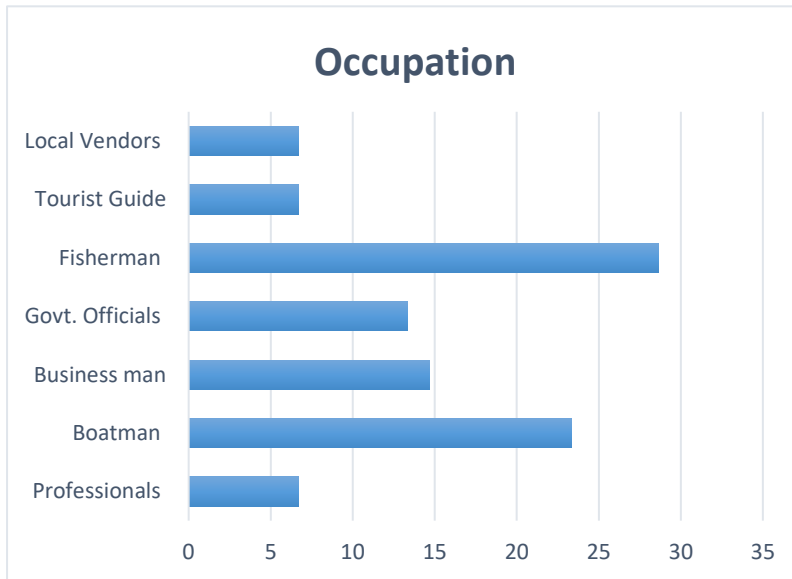
It was found that in primary survey respondent participated have income profile of all segment are the user of water transport, therefore the findings ensured that if IWT will be developed at Varanasi the ridership & demand will be there and IWT operators will gain the profit.

The demographically stakeholders of all income group will be highly benefited with the development of Inland Water Transport.

(Fig No. 162.21)

4.25.9 Primary Survey Findings No. 9

“Stakeholders Demographic Assessment – Occupation of Respondent”



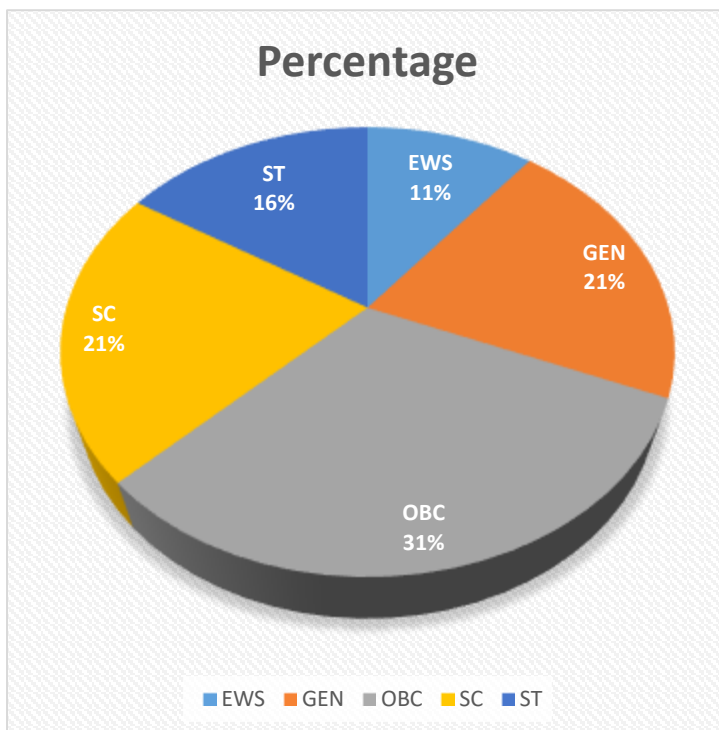
(Fig No. 162.22)

The respondent participated in primary survey are belongs from multiple occupations and working profile, the need of water transport is required for mostly every one at Varanasi.

The Analysis of primary survey that Fisherman, Boat Man, Business Man and Individual associated with trade and tourism will be going to get maximum millage of Inland Water Transport services at Varanasi region.

4.25.10 Primary Survey Findings No. 10

“Stakeholders Demographic Assessment – Category of Respondents”



(Fig No. 162.23)

The demographic assessment was also being carried out from the available data of primary survey, it was found that in majority the population of unprivileged sections of the society are living along the banks of river bank, as we see this pi chart analysis we easily conclude that 31% of OBC community, 21% of SC, 16% of ST and 11% of Economically Weaker Section community are going to be get benefitted with development of Inland Water Transport sector at Varanasi, These marginalized section of populations are living along the banks of river Ganga.

4.25.11 Primary Survey Findings No. 11

Stakeholders Perception Survey for Inland Water Transport Development at Varanasi

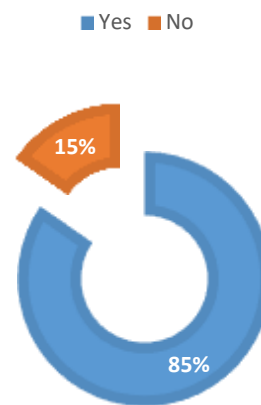
Primary survey was conducted across the river bank with prospective stakeholders such as tourist, local public, country boat operator, fisherman, religious groups etc. total 150 random sample survey has been taken and close focus group discussions followed by interview were also been conducted and tried to find the socio-economic benefits and possibilities that are associated with the development of Inland Water Transport facility at Varanasi.

Question:

Do you aware about development of water transport in your city?

Survey Findings:

The questions were asked from 150 random sample populations with all prospective IWT users and stakeholders whomsoever being getting directly or indirectly getting benefitted with the development of Inland Water Transport system at Varanasi. Are they have awareness about the IWT Sector. The positive response from 85% of sample population received that they are aware about the development and benefits of Inland Water Transport



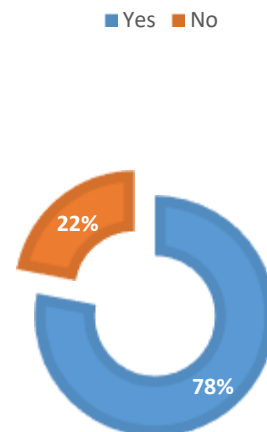
(Fig No. 162.24)

Question:

Dose the development of Inland Water Transport at Varanasi will Reduce the congestion of your city traffic?

Survey Findings:

The 78% of sample populations have responded that in primary survey that development of Inland Water Transport System will help out in reducing the congestion of traffic along the streets of Varanasi city. Therefore, we may conclude that majority of population will be getting benefitted with the development of IWT sector services at holy city Varanasi. As the urban establishment of the Varanasi city is dense and congested, the development of urban transport system will help out in curbing routine traffic and help in providing ease of mobility in the city.



(Fig No. 162.25)

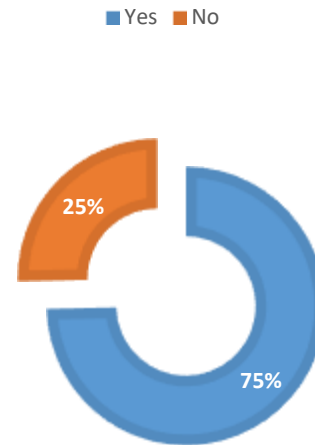
Question:

Can IWT will makes your local transport more efficient for travel?

Survey Findings:

The 75% of Sample Population feels that development of Inland Water Transport at Varanasi will help out the city in making local public transport more efficient for daily commuting and travel.

(Fig No. 162.26)



Question:

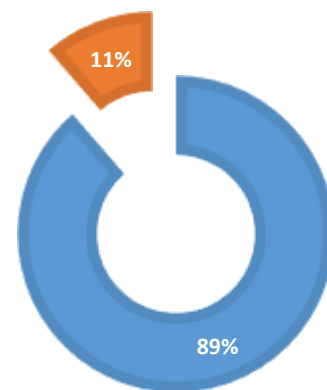
The development of water transport improve bank to bank transport?

Survey Findings:

Total 89% of sample survey population believes that development of Inland Water Transport system at Varanasi region will help to improve bank to bank connectivity despite availability of three bridges. The Water Transport Services facilitates in reducing travel time and congestion of the city traffic.

(Fig No. 162.27)

■ Yes ■ No



Question:

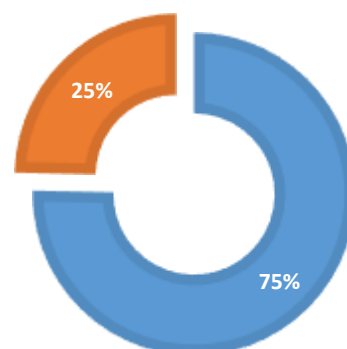
Do you think IWT will reduce travel time & cost?

Survey Findings:

75% of the sample population has shown their believes that Inland Water Transport helps in reducing overall total travel time for commuting to the city by the regional population and Inland Water Transportation will cost lower as compared to the any other surface mode of transport.

(Fig No. 162.28)

■ Yes ■ No

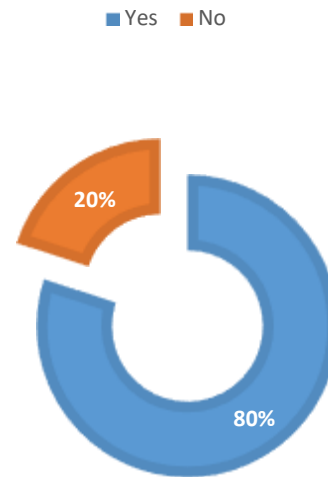


Question:

Dose IWT transport may benefit fisheries sector

Survey Findings:

80% of the sample population believes that fisheries sector may get benefitted with development of IWT sector, in survey it was identified that fisherman community largely dependent on the river Ganga and their main livelihood source are fishing activity from the river, so this findings clarified that fisherman are being in large scale getting benefitted with development if Inland Water Transport.



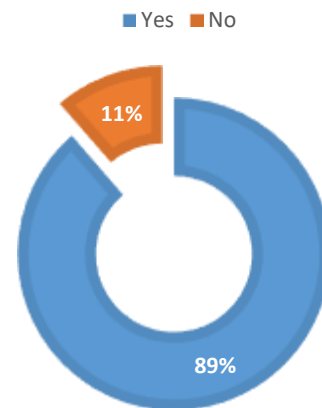
(Fig No. 162.28)

Question:

Dose inland water transport promote tourism sector?

Survey Findings:

The tourism activity in the Varanasi city are already being flourishing since long age, the main attraction are alluring Ganga Ghats where tourist and local public gather to witness spiritual, religious and cultural activity of Kashi or Benaras. In primary survey 89% of population have agreed that development of Inland Water Transport at Kashi will promote tourism activity in the city and IWT has potential for development of cruise-based river tourism.



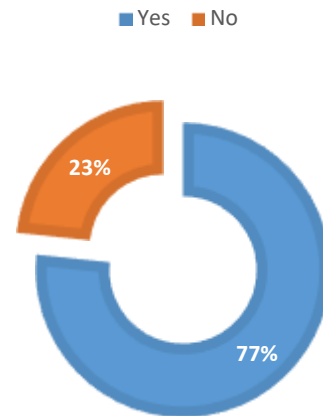
(Fig No. 162.29)

Question:

Do you think IWT transport improve local access and connectivity in the region

Survey Findings:

The 77% of sample population are reported that IWT transport development will improve local access and regional connectivity of the Kashi city.



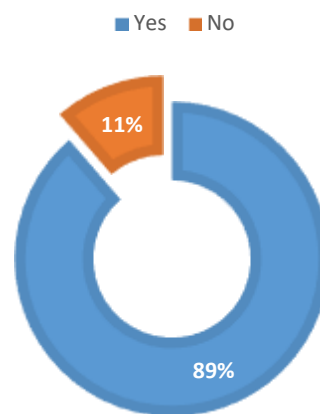
(Fig No. 162.30)

Question:

Does water transport provides new employment opportunities?

Survey Findings:

Inland Water Transport opens up the varied opportunity for generating commercial activity in the Varanasi city, the government has also emphasis that IWT will generate new avenues of employment opportunity and during primary survey the majority 89% of public agreed that IWT will generate new employment opportunity at Varanasi



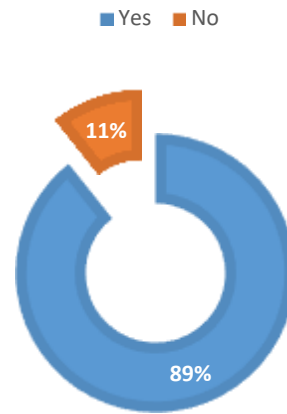
(Fig No. 162.31)

Question:

Do you agree that Water Transport has potential for creating better recreational services?

Survey Findings:

The 83% of survey respondent has agreed that IWT has potential for creating better place of recreational services.



(Fig No. 162.32)

Question:

Are you agree that water transport will improve your livelihood earning sources

Survey Findings:

The 89% of survey sample has reported that development of water transport enhances trade, transport and tourism activity along the Ganges Ghat and it effect to improve livelihood earning sources of the local population.

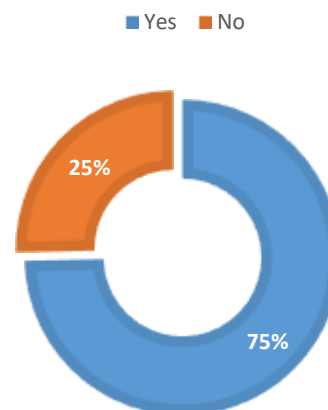
(Fig No. 162.31)

Question:

Do you agree water transport will support environment.

Survey Findings:

Inland Water Transport is environment friendly mode of transport as it has capacity of transport larger cargo weight with lower consumption of fuel, the water transport offers smooth navigation and hindrance free travel so the 75% of local pubic agree that IWT is environmentally friendly mode of transport.



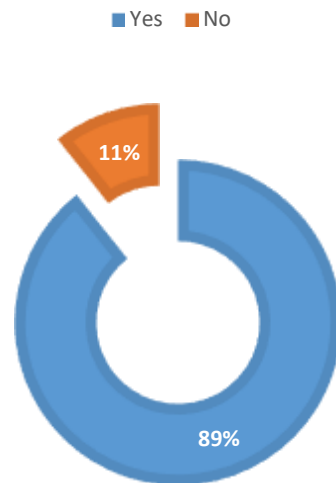
(Fig No. 162.33)

Questions:

Do you think water transport is safest mode of transport for daily commuting?

Survey Findings:

The 89% of survey respondent agree that IWT is safest mode of transport at Varanasi city, the road accidents prevalence are recurrently happening in congested city like Kashi and traffic congestion are very common, under such circumstances the Inland Water Transport services options are coming up as safest options.



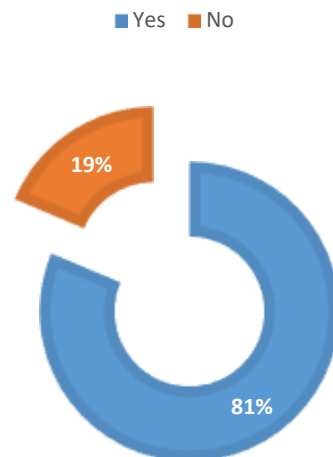
(Fig No. 162.34)

Question:

Does water transport of your city will be cost effective mode of transport for daily commuting

Survey Findings:

81% of sample survey population agreed that water transport freights are cost effective for them in daily commuting to the city.



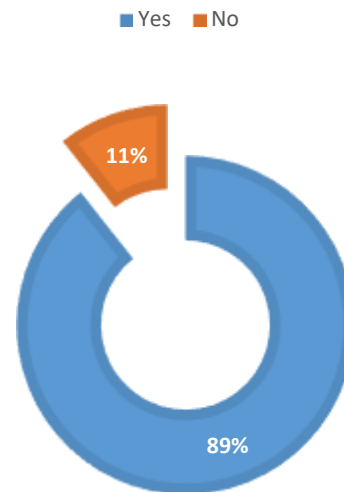
(Fig No. 162.35)

Question:

Are you agree that development of Inland Water Transport require capital investment

Survey Findings:

To understand border economic perspective of IWT development, the questions regarding investment factored has been asked from the stakeholders, the majority of 89% IWT stakeholders agreed that Inland Water Transport development will attract capital investment in the city for infrastructure creation.



(Fig No. 162.36)

4.25.12 Primary Survey Findings No. 12

Inland Water Transport is complimentary for Tourism Sector in generating regional income & employment opportunities

The interview was conducted along the Ghats of river Ganges at Varanasi, it was observed that thousands of small crafts and boats were presently operated by the coastal community living along the Ganga Ghats like Fisherman, Boatman, Nishad community etc. are serving to the society since long years. Now the spurt for developing Inland Water Transport System may strengthen by making availability of high standard amenities and safety of boat ridership

Question:

How long you are living along the Bank of River Ganga and what economic activity carried out?



(Fig No. 162.37)

More than 150 surveys samples were collected by interviewing coastal community along the hinterlands of river Ganges at Varanasi region, where it was found that 80 percent of the community has established them self since more than of 15 years. These community lives along Ghats or Costas of river side and the major sources of Income is through the money received from Boat riders, Fishing and carrying local goods from bank to bank of the rivers. Therefore, they were highly depended upon the economy of rivers.

In depth interview with costal community who lives along the river Ganga since more than of 5 years, they revile that their economy and earnings were highly depended upon the river resources.

The coastal populations carried out several economic activities with help of river water resources and tourism activities axis their livelihood sources.

The primary data clearly indicates that the shared populations percentages living more than approximate 10 to 15 years old, they actively participate for river related economic activity, as they are more experienced belongs to the higher productive age group therefore, they capable catch premium revenue through offering ridership for tourist.

The above graph represents that the demand for carrying passenger (Tourist + Local) is very higher and this segment has good revenue generation opportunity.

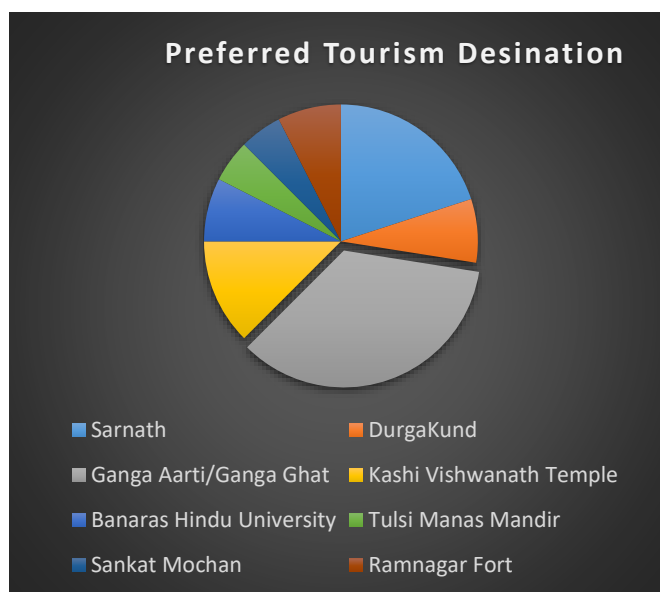
Question:

According to you which place/sites of Varanasi is more liked by you ?

The Maximum number of tourists has shown their interest for visiting at Ganga Ghats at Varanasi to witness the Ganga Aarti especially in Evening time

Ganga Aatri is the shining bliss of the city, the chanting of Mantra and Aarti in the evening spreads divinity in the surroundings.

Every day millions of tourist and local public gathers near Ganga Ghat to Worship lord Shiva and Mata Gange, the priest and devotes burns the incense sticks and light up Ghee Dipak of Aarti. Mother Ganga is worshiped with smell of camphor and goose bumping-inducing Aarti spreads purity in the air.



(Fig No. 162.38)

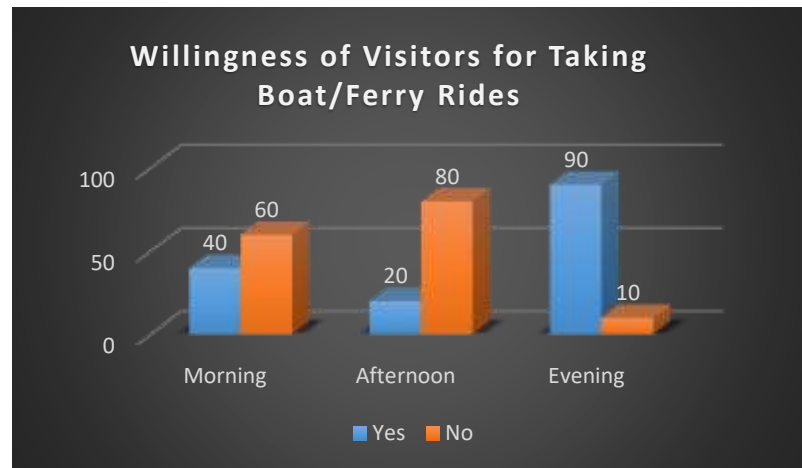
Ganga Ghats are one of the prominent cultural and heritage sites, the whole water front is full of religious activities in the evening, the panoramic view of Ganga Ghats in the evening is every tourist choice to witness and save the memory of life time. Majority of the tourist came to Varanasi to see the Ganga Ghats and sensitize the vibrant heritage cultures of the city. The presence of

Water Transport facility along the Ganga Ghats attracts and accommodate a greater number of tourists, ultimately increase their revenue share too.

Question:

Have you taken boat rides to experience the Ghats of Varanasi and what timings you prefer to visit at Waterfront

The responses collected from the visitors to know their willingness for taking rides of boats and ferry to experience the Ghats, as Responses in figure no. 146 Shows that majority of tourist and local populations prefer to visit Ghats in evening time, as the development of Water Transport at Varanasi must having surge of passenger ridership in evening time only.



(Fig No. 162.39)

The analysis of primary data reveals that there is demand already in place for ferry and boat rides, therefore, strengthening of water transport services along the Ganga Ghats of Varanasi will promote the tourism and other related economic activities.

Ganga Ghats has many religious and souvenir shops that also attract thousands of tourists for shopping along the local Haats on the river bank. Hence development of tourism activities flourishes the local regional economy in many aspects.

Ganga river front is old heritage zone of the city and this site is proposed to be listed into the heritage list of UNESCO, the river Ganga is like an artery of the city, the Ghats of Benaras was prepared in different periods by different persons, it was revealed that many Ghats of Varanasi is older than the history.

Inland Water Transport offers multiple benefits in development of regional economy, as due to presence of pilgrimage the tourism activities are very highly active and dynamic in the area, there are presence of many religious, traditional and commercial activities carried out along the various Ghats of river Ganga.

Among the 84 Ghats of Banaras, the five Ghats were called as Panchtirth which considered as most scared among all Ghats i.e Assi Ghat, Dashaswamedh Ghat, Manikarnika Ghat, Panchganga Ghat, Adhikeshav Ghat. In between Darbhanga to Manikarnika Ghat the seven kilometres of water front stretch has highest concentration of tourist visits and pilgrimages, this stretch also forms the antagriha that in forms of Kashi Viashwanath temple.

4.25.13 Primary Survey Findings No. 13

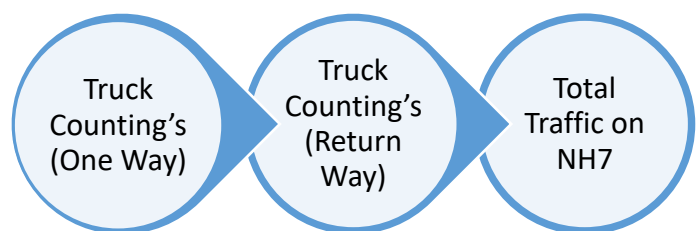
“Cargo Potential Analysis of Varanasi through Truck Counting Survey”

Truck Passing through the National Highway - 1 Ramnagar Bypass Road, Varanasi NH 7				
Morning, Afternoon Counts				
Time	5:00 AM -6:00 AM	09:00 AM to 10 AM	12:00 PM to 1:00 PM	3:00 PM to 4:00 PM
Towards Allahabad	100 Trucks	120 Truck	90 Truck	111 Trucks
Towards Mughalsarai	85 Trucks	132 trucks	87 Trucks	125 Trucks
Evening & Night Counts				
Time	6:00 PM to 7:00 PM	9:00PM to 10:00 PM	12:00 AM to 1:00 AM	3:00 AM to 4:00 AM
Towards Allahabad	116 Trucks	140 Trucks	126 Trucks	122 Trucks
Towards Mughalsarai	110 Trucks	80 Trucks	87 Trucks	115 Trucks

(Table No. 37.5)

The truck counting survey helps in understanding the total profile of logistics traffic passing through the existing modes of transport and the upcoming terminals is located at strategic point therefore cargo shifting possibilities exist here for National Waterways. The carriage truck counts survey conducted on hourly basis in four different timing of the day, hourly truck counting helps in tapping for the idea of traffic loads, cargo type, identification of Origin and Destination pairs etc.

Key information regarding cargo movement patterns for existing modes of transports are identified, further the detailed interviews are conducted with the truck drivers along the various Dhabas on the NH7 aiming to gather qualitative information's of supply chain sources, assessment of existing freight rate, return loads possibilities, distance, time and other related constraints to be identified.



(Fig No. 162.40)

4.25.14 Primary Survey Findings No. 14

“Assessment of traffic potential in respect to Varanasi MMT region”

Six steps methodology has been followed for measuring regional market cargo traffic, as roadways traffic are more likely to be divertible on waterways, but condition to the Origin-Destination pairs of exiting traffic movement patterns matches freight flow patterns with IWT.

As per the detailed survey of truck survey leads to identify the total regional traffic available at Varanasi region is approximate 20.8 MMTPA (Million Metric Tons Per Annum)

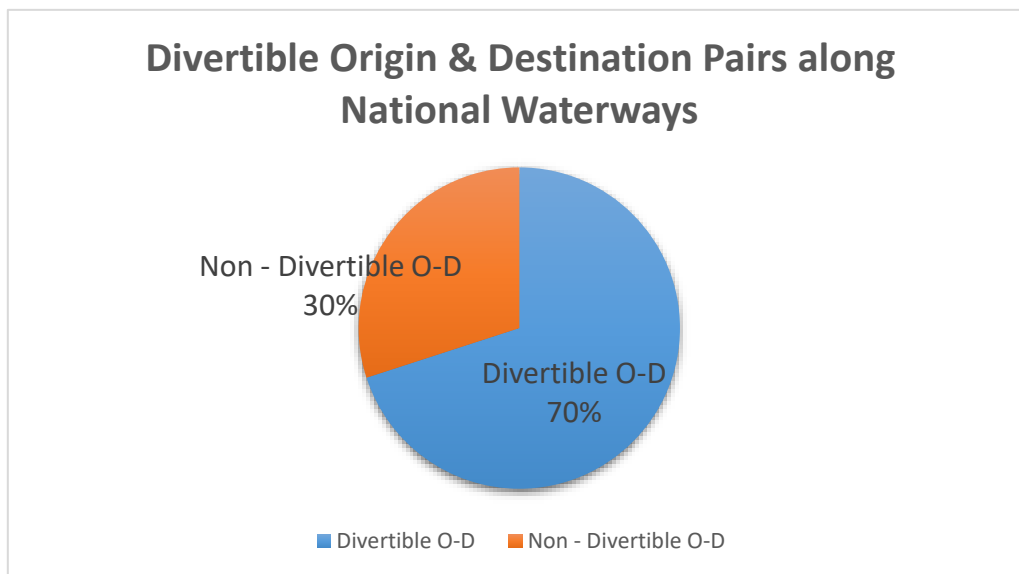
Parameters considered for calculating market Traffic for roadways at Varanasi region		Towards Prayagraj (A)	Towards Mughalsarai (B)	Total (A+B)
STEP I	Cumulative counting's of trucks Movement (Morning + Evening) total counting's for 8hrs in different timing in a day	978	752	1,730
STEP 2	Average number of truck passes NH 7 per hour	122	94	216
STEP 3	Assessment of total truck passes NH7 in 24 hrs.	2,934	2,256	5,190
STEP 4	Considered average truck loading capacity is 22 MT for calculating total freight passes through Varanasi region in MT	64,548	49,632	1,14,180
STEP 5	Considered assumptions of 50% of empty returns during calculating traffic moved per day (MT)	32,274	24,816	57,090
STEP 6	Total Yearly Traffic	117,80,010	90,57,840	208,37,850

(Table No. 37.6)

4.25.15 Primary Survey Findings No. 15

“Analysis of divertible cargo traffic on Waterways through MMT Varanasi”

Out of 150 random sample survey taken along the NH 7 the data ‘of traffic passages reflects that 70 % of the roadways traffics are moving along the various origin - destination pairs of the hinterlands of National Waterways – 1, now it is clear that, the said traffic can be possibly diverted along the various routes of National Waterways from identified O-D pairs during the random survey.



(Fig No. 162.41)

4.25.16 Primary Survey Findings No. 16

“Assessment of Economical Viable Origin – Destination Pairs with Inland Water Transportation & Re-routing of Cargo through MMT Varanasi”¹⁸

During the interactions with stakeholders, it was identified that majority of stakeholders have been using roadways mode of transportation, they organise their cargo supply with help of truck transportation, some of them uses railways mode to transport for longer distance where truck transportation is not available.

Vehicle cost has major investment in the transport as well as interest and depreciation of the capital. This fixed cost investment they incurred independently in transportation Industry.

Fixed operating cost expenses related to the wear and tear, vehicle insurance and EMI and size of depreciation of asset are determined under fixed category

Variable cost includes maintenance, repairs incurring, fuel, spares and taxes, challans and legal charges etc.

¹⁸ Primary data analysis - The List of Viable O-D pair are developed based upon cargo flow pattern in the catchment areas of river Ganga flows

Roadways and railways modes of transportation overheads are always higher to the Waterways cost. The economics of waterways are become game changer in transportation industry.

Well prepared selection of supply chain offers better strategic advantages in reduction of cost of Input and lower the overheads cost of produced goods in supply and distribution.

A shipper needed to trade – off in between the cost and selling price, therefore cost incurring on transportation of goods are decisions factors, and the decisions of transportation impacted responsively to the whole business.

The transporter and shipper both looks window specified by the customer and make their profit within the specified limits. The rising of cost in transportation, the margin was reduced for transporter as well as difficult to get competitive transport cost to the shipper to beat competition.

During field survey the detailed information was seek on freight cost, cargo type, distance in kilometres and place of origin and destination of cargo etc.

This information has led for drawing various analysis related to the transport requirements of the shipper but research inclined with objectively for Water Transportation, therefore the data set is realigned according to access the viable O-D pairs that suited for diversion along National Waterway-1

Following o-D pairs are identified economically feasible when compared with roadways and railways mode of transport.

These O-D pairs are competitive in terms of cost, time and reliability, it was also conformed in survey that the below O-D pairs are either originated or destined with O-D pairs aligned with NW-1 hinterland areas.

With this assessment the regional demand patterns of the goods are also detected and it helps to offer the transportation facility according the goods and needs of the shipper.

The cost of transportation for per ton per kilometre is identified based on taking the average of cost and kilometres data of origin and destination pairs that are aligned with the hinterlands of waterways.

The O-D Pairs are separately analysed for roadways, railways and waterways modes and the constraints involved in each type of transport modes are considered during the cost findings

Below table has shown the detailed O-D pairs for each route that Identified during volumetric survey with truck operators along the National Highway-7 near to the MMT Varanasi

Based up on the primary data availability, few assumptions are considered in identifying the waterways cost. As in present scenario the IWT mode is not established therefore cost comparative data identified with help of extrapolation of data available.

Tabular Analysis of Economic Viable Origin - Destination Pairs along NW-1 hinterlands by referring through MMT Varanasi as Origin Port or Destination Port

Origin	Origin Port	Destination	Discharge Port	Commodity	Roadways Cost Per Ton-Kilometre	Railways Cost Per Ton-Kilometre	Waterways Cost Ton-Kilometre	% Waterway Cost lesser than Roadways by	% of Waterway cost lesser than Railways by
GHAZIPUR	MMT VARANASI	BHUWANESHWAR	GR JETTY KOLKATA	BIKE	3.49	2.91	2.14	38.53	26.24
MAJHIGWA (M.P)	MMT VARANASI	BAKUDD (West Bengal)	GR JETTY KOLKATA	Mustard Seeds	3.66	2.72	1.93	47.31	29.08
Jamshedpur	MMT SAHIBGANJ	Lucknow	MMT VARANASI	Window	4.40	2.65	2.22	49.48	16.18
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Stationary Items	5.00	3.82	2.71	45.76	29.08
Jharkhand	MMT SAHIBGANJ	Rajasthan	MMT VARANASI	Iron	2.80	2.33	1.85	69.47	63.37
orissa	GR JETTY KOLKATA	Kathgodam	MMT VARANASI	Bearings	4.04	2.87	1.21	70.13	57.88
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Bamboo	3.45	2.55	1.17	66.26	54.21
Ranchi	MMT SAHIBGANJ	Muradabad	MMT VARANASI	Oil lubricant	3.82	2.36	1.17	69.47	50.68
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Paper	4.80	3.20	1.64	65.78	48.67
Patna	GAAY GHAT TERMINAL	Allahabad	MMT VARANASI	Iron Rods	11.62	7.84	2.25	80.66	71.32
Varanasi	MMT VARANASI	Bhagalpur	IWT JETTY BHAGALPUR	Cement	7.40	4.40	2.17	70.65	50.63
Siliguri	FLOATING TERMINAL FARAKKA	Varanasi	MMT VARANASI	Plywood	6.43	5.00	1.81	71.84	63.79
Dala	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Cement	10.56	6.11	2.31	78.11	62.20
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Machinery Parts	4.80	3.10	1.64	65.78	47.01

Gurugram	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Car	4.18	2.00	1.76	81.92	62.20
Jamshedpur	MMT SAHIBGANJ	Meerut	MMT VARANASI	Steel	4.14	2.71	1.92	77.89	66.26
Kanpur	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Tyres	5.50	4.10	1.64	70.13	59.94
Kolkata	GR JETTY KOLKATA	Varanasi	MMT VARANASI	Sarees & Cloth items	7.00	4.67	1.83	73.93	60.89
Kanpur	MMT VARANASI	Guwahati	PANDU JETTY	Iron Sheets	6.33	5.00	2.02	68.09	59.58
Kanpur	MMT VARANASI	Asansol	GR JETTY KOLKATA	Furniture	10.63	5.63	2.00	81.17	64.44
Ghaziabad	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances	3.18	2.00	1.76	76.24	62.20
Noida	MMT VARANASI	Patna	GAAY GHAT TERMINAL	Electrical Appliances	4.09	2.09	1.82	80.00	60.87
Kolkata	GR JETTY KOLKATA	Kanpur	MMT VARANASI	Cloths	3.50	2.70	1.85	47.14	31.48
Mumbai	MMT HALDIA	Varanasi	MMT VARANASI	Machinery Parts	4.33	2.47	1.47	66.15	40.54
Varanasi	MMT VARANASI	Mumbai	MMT HALDIA	Carpet	4.13	3.20	2.93	29.03	8.33
Gurugram	MMT VARANASI	Dibrugarh	PANDU JETTY	Motor Bike	3.33	1.88	1.26	62.11	32.64
Haryana	MMT VARANASI	Guwahati	PANDU JETTY	Food Grains	4.25	2.75	1.75	58.82	36.36
Punjab	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Agriculture Equipment's	6.43	4.86	2.35	63.50	51.69
Chandigarh	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Chemicals Products	2.50	1.78	1.94	62.22	46.88
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Paper	5.71	3.93	2.17	62.11	44.89
Kanpur	MMT VARANASI	Haldia	MMT HALDIA	Rubber & Leather	6.18	4.09	1.68	72.88	59.02
Allahabad	MMT VARANASI	Kolkata	GR JETTY KOLKATA	Fertilizer	7.38	4.75	2.05	72.16	56.77
Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tea leaves	5.36	3.21	2.17	59.58	32.64

Assam	PANDU JETTY	Varanasi	MMT VARANASI	Tick Woods logs	4.25	2.69	1.89	55.42	29.51
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(Table No. 37.7)¹⁹

2. Primary data analysis - The List of Viable O-D pair are developed based upon cargo flow pattern in the catchment areas of river Ganga flows

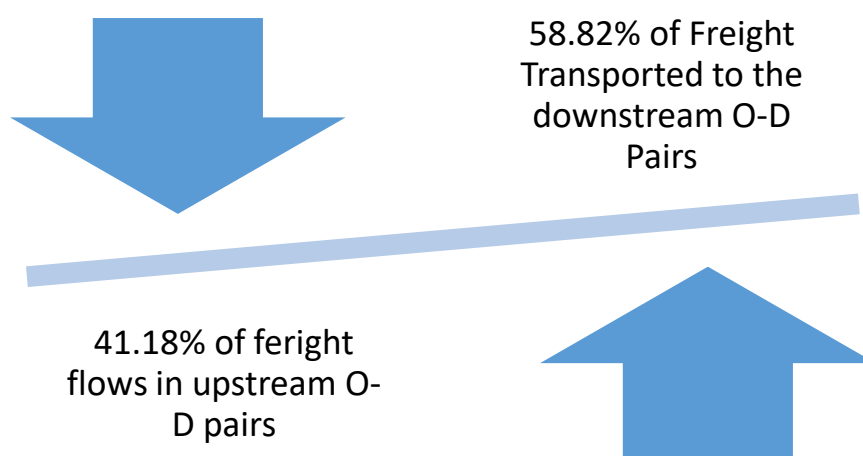
4.25.17 Primary Survey Findings No. 17

“Analysis of Freight Flows Upstream Vs Downstream”²⁰

The traffic assessment for Varanasi region is made through volumetric survey conducted with stakeholders i.e truck operators, warehouse owners, cargo operators, shippers and Industrial units of the region, however stretches of National Waterway – 1 is 1620 Kilometre from Allahabad to Haldia. But the study focuses to understand economic impact of IWT sector in Varanasi region and how this sector may economically benefit to the area.

The study of data and approach used has revealed importation on cargo flows pattern in upstream and downstream flows directions of the river Ganga. Basically, IWT Voyage directions are taken to consider the freight flows in Upstream or Downstream O-D pairs and details extracted by data crunching and mining.

The majority of freight flows pattern were identified for downstream cargo, approximate 58-60% of the freight flows pattern were in downstream. However, for upstream freight flows are limits up to approximate of 41%, hence it is clear indicator that two ways Voyage cargo opportunity are available on National Waterways -1



(Fig No. 162.42)

²⁰ This section is added after the Pre-Thesis Submission Seminar on the demand of evaluators, however the entire thesis document contained research analysis based on primary & secondary data both.

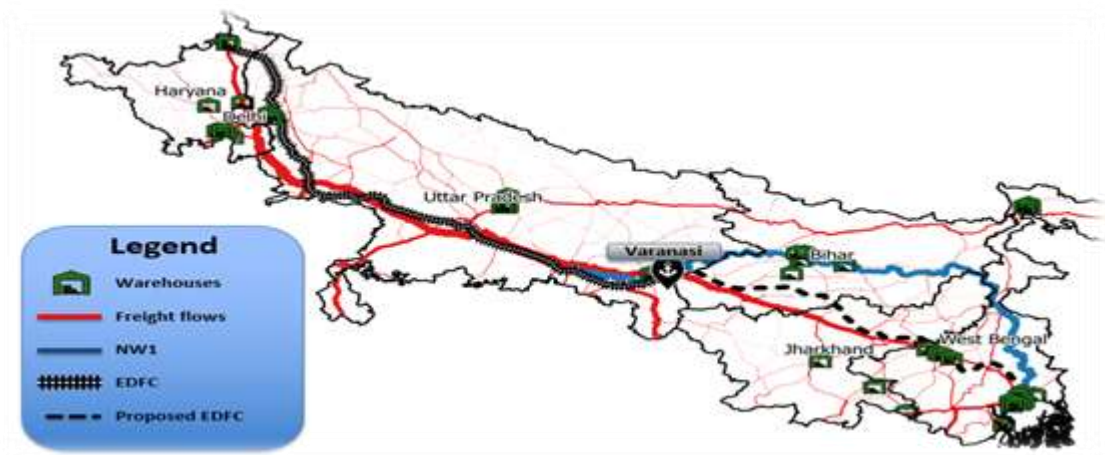
Chapter-5

Discussion

5.1 Geo –Economic Features of MMT Varanasi, Uttar Pradesh

Varanasi Inland Waterways River port located on strategic focal plane geographically IWT port Varanasi in future may supports in movement and transshipment of voluminous cargo. The proposed logistics chain with IWT where eastern dedicated freight corridor (EDFC) phase 1 is landed up to Varanasi, and it was proposed to connect further with the MMT Varanasi with rail head from Jeonathpur railway station. Secondly, the golden quadrilateral road also passes through MMT Varanasi that makes IWT port strategically best suited for cargo transshipment, therefore, IWT Varanasi become comfortable zone for Cargo handling in future.

For development of required water transport facility government of India is developing mammoth infrastructure for handling cargo and aggregation. Harnessing of water potential of river Ganga for transportation purposes that creates flexibility in operating and mobilizing cargo transportation in the region and facilitate trades.



(Fig. No.163. Strategic Location of Varanasi for Development of Riverine Port Development along river Ganges.)

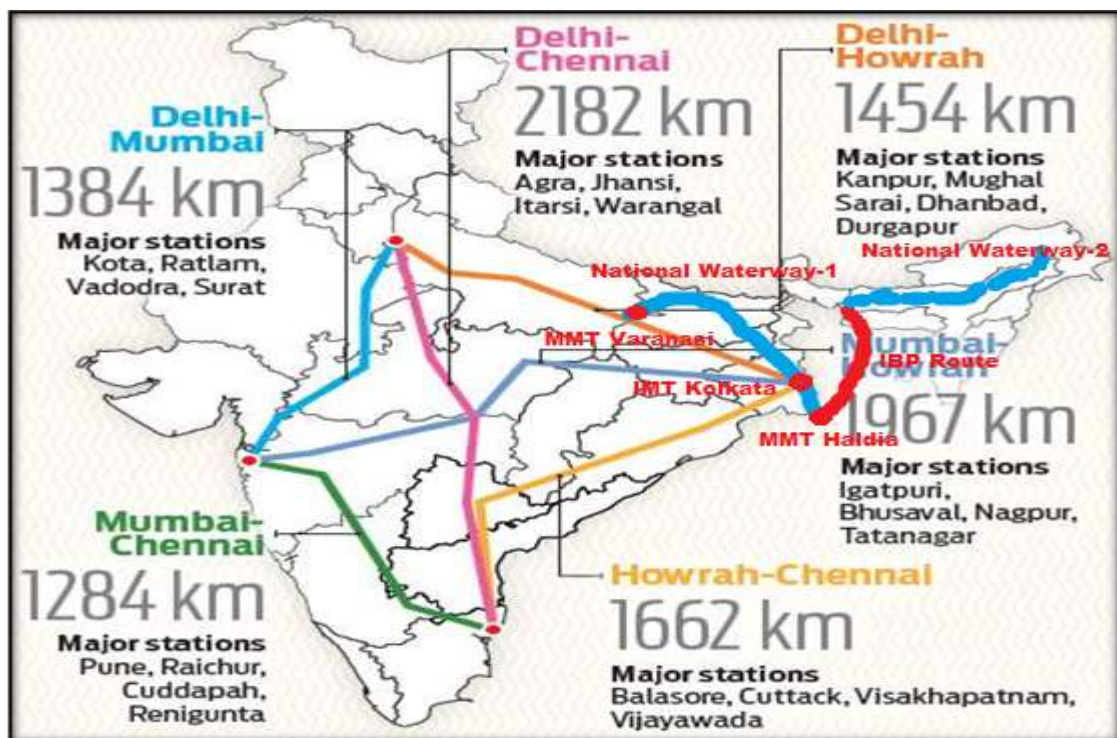
¹NW-1, together with the proposed Eastern Dedicated Freight Corridor (EDFC) and a number of National Highways (NH-1, NH-2, NH-80 etc.) constitute the Eastern Transport Corridor of India, connecting the National Capital Region with Kolkata, the seaport gateway of India to the Bay of Bengal. It is estimated that the annual freight flow through the corridor is about 370 million tons. The total freight flow generated from or destined to the six States in the corridor is about 40% of the overall flow of cargo in India. In spite of a significant difference in geographical distance, the States of Bihar and Uttar Pradesh prefer the western sea ports of JNPT and Kandla over the Kolkata Port, while the port usage for Jharkhand is equal between the western ports and Kolkata. This is largely due to the limited choice of transport mode, poor hinterland connectivity. On the other hand, West Bengal and the hinterland have the potential to become the gateway for trade with the East because of its close proximity to Orissa and Chhattisgarh (one of the major mineral belts of India), access to North East Region and link to Bangladesh, Myanmar, Thailand, Nepal and other east and south-east Asian countries. In order to attract movement of substantial portion of cargo from the western ports to the Kolkata port and

¹ Reference Manual on Inland Waterways Transport Statistics report, Version 9.1 issue April 2018, Published by Eurostat

to the rapidly growing Paradip and Dhamra ports in Odisha and to open up vast opportunities in inland as well as ex-India movement of cargo through this transport corridor, a requirement of developing NW-1 with the necessary infrastructure and assured depth in the navigational channel was proposed.

5.2 Integration of Golden Quadrilateral Super Highway with Varanasi MMT

²Government of India has made efforts under Sagarmala and Bharatmala to make linkages of roadways, highways, railways and waterways network freight transportation corridors, we already aware about importance of strengthening connectivity in between Delhi to Kolkata. The major share of population percentages are living in this region. the Inland Water Transport – through National Waterway-1 from Varanasi to Haldia 1320 Km Inland Waterways Network is connecting with MMT Varanasi and Kolkata. Therefore, integration of maximum possible logistics asset of government is possible at focal point of MMT Varanasi.



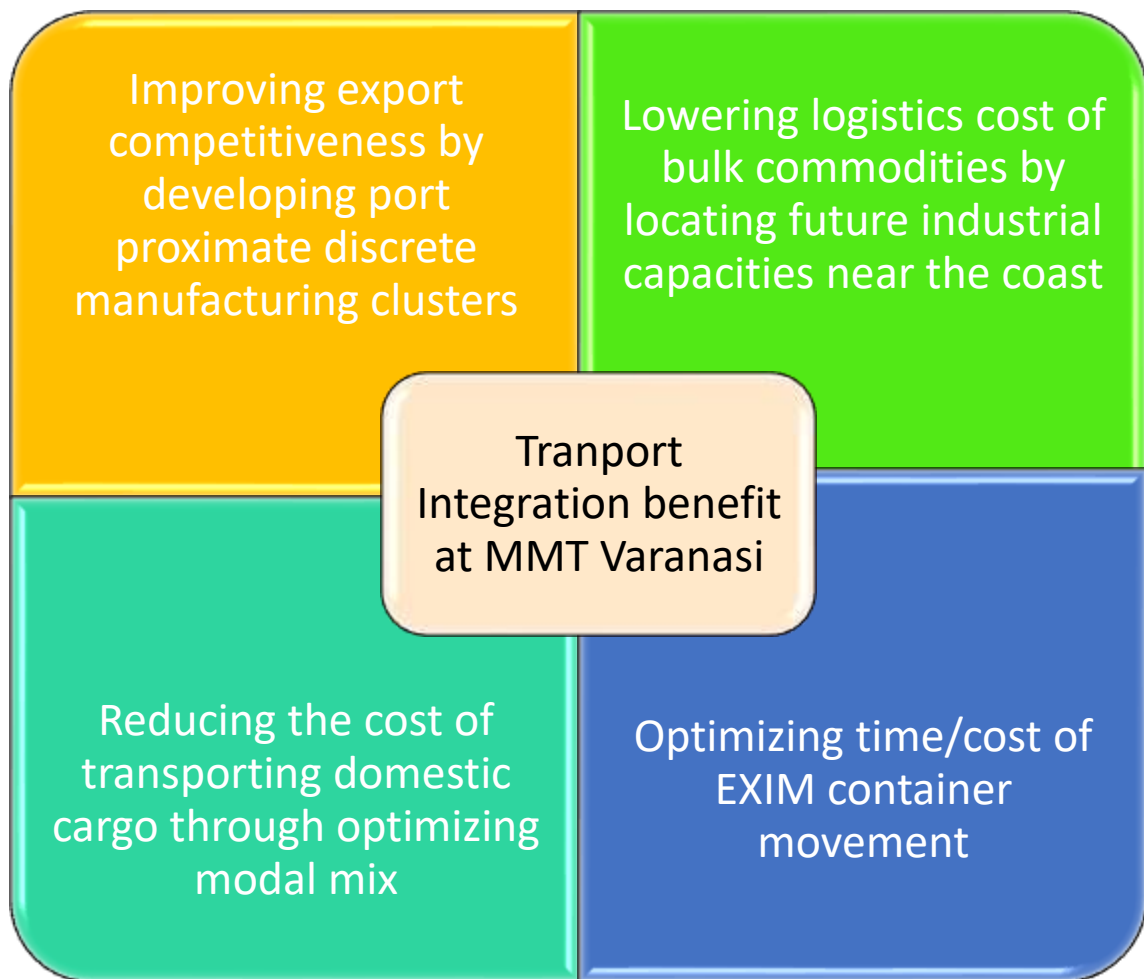
(Fig. No.164 Integration of Golden Quadrilateral at MMT Varanasi)

5.3 Benefits of Integration of Railways, Roadways with MMT Varanasi.

The integration of transport infrastructure at MMT Varanasi plays pivotal role in increasing the trades and logistics performance of the country, presently the expenditure incurred on logistics are double than the GDP growth rate, as we compare the logistics cost of the developed nation their overall expenditures on transportation are in between 8 to 9 percent of their budgeted expenditure and GDP.

Therefore, India has understood their importance of rivers water resources and decided to develop Inland Water Transport Infrastructure to harness the maximum economic benefits from the available resources.

² PPT on Ports, Presented by India Brand Equity Foundation, www. Ibef.org issue January 2018.



(Fig No.165 Benefits of IWT Transport Integration)

5.4 Inland Water Transport develops potential Gateway of Opportunities in Varanasi for Promoting Bilateral Trades with Neighbouring Countries

India with its inherit geographical conditions being linked with several neighbouring countries where connectivity to the global market is linked with the Indian transport routes.

Nepal and Bhutan Being land locked neighbouring countries their international freight transport relates on services managed with India's helps, therefore incorporating of MMT Varanasi, Inland Water Transport facility manages logistics of neighbouring countries and possibly extend opportunities for developing diplomatic relationships.

The other neighbouring countries in eastern parts of India like Bangladesh and Myanmar are also having key role in development of strategic linkage of river for enhancing inland maritime trade business for India and also spurt for developing IWT based logistics network in north eastern states of India.

India Bangladesh Protocol route focus for improving logistics connectivity to the North Eastern Region (NER), From Varanasi to Haldia (Ganga – Bhagirathi – Hooghly) river system is linked by India for transporting cargo on IWT routes whereas the IBP treaty

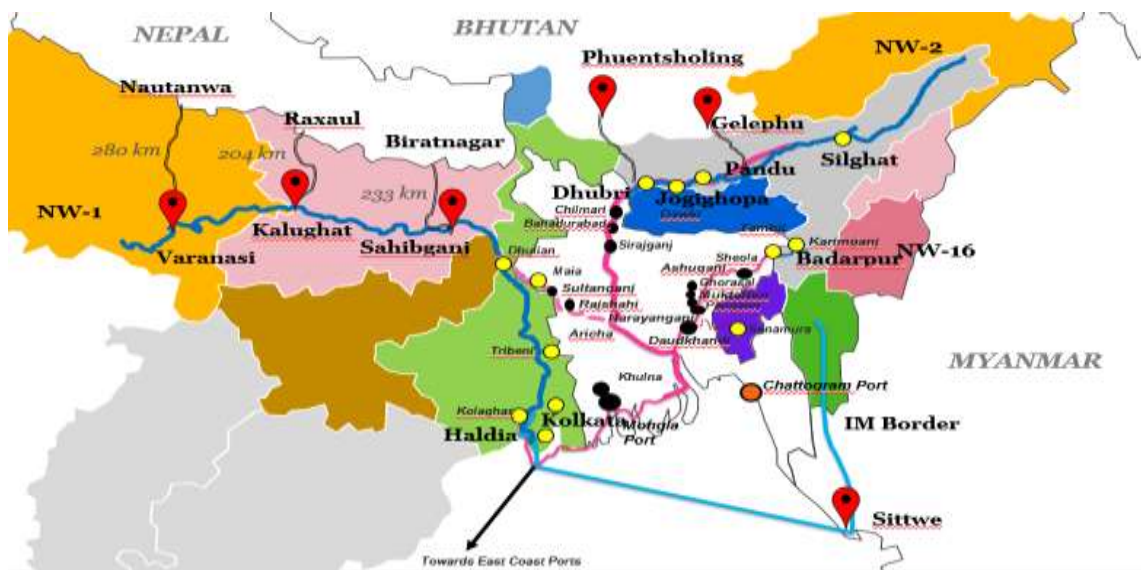
with Bangladesh allows for mutual benefits for both countries to connect North Eastern Region of India with river Bhramputra and Karimganj (Assam).

Jal Marg Vikas Project on National Waterways -1 has witnessed the cargo movement from NW-1 sector to Bangladesh and North Eastern regions of India through Indo Bangladesh Protocol routes. The development of Multimodal IWT Port at Varanasi established healthy trade co-operations and diplomatic relationships with these countries.

Inland Water Transport becomes alternative options among these countries, India has taken major steps for harnessing the potential utilization of water resources for transportation purposes and Jal Marg Vikas Project initiative for development of National Waterways -1 expected to provide seamless navigation of vessels from Varanasi to Bangladesh to Dhubri (Assam)

The interlinking of Ganga-Bhagirathi-Hooghly river system with Indo Bangladesh Protocol routes with Bharamputra River develops integration of several waterways networks to expand the logistics gateways in eastern regions of India and neighbouring countries.

The governments of both countries have agreed on the develop SOP for the movement of cargo with Inland Water Transport routes and these IWT development efforts reduce logistics cost and improve trade competitiveness in North Eastern regions of India.³



(Fig. No.166 Maps Indicating NW-1, MMT Varanasi, possibility of IWT trades and transport connectivity with neighbouring countries)

The development of National Waterways – 1 increases the trades and transport gateways with the eastern regions of India, however in context to the Multi Modal Terminal Varanasi. It may offer seamless transport connectivity for enhancing trades with land locked neighbouring country Nepal. The report of world bank has revealed that Nepal 40% of international freight shipment (Export and Import) handled through the routes of India, therefore, under such conditions the development of Inland Water Transport Ports on river Ganges is economic profitable party for India, as India is focussing for doubling

³ File No. 24(1)/PFII/2006, Guidelines of Ministry of Finance, Govt. of India

their economy soon under such circumstances, partnering with Nepal on IWT routes for handling cargo, may enhance the business development of logistics at Varanasi region.

Inland Water Transport strengthen the Indo-Nepal economic relations by increasing the bilateral trades, the treaty of 1971 in between Nepal and India the duty free access on the items manufactured in Nepal has been allowed in India and maximum percentage of Nepal international cargo going through or coming through via sea routes takes the Indian routes, therefore, under such prevailing circumstances the development of Inland Water Transport facility in Varanasi and along the National Waterways may prove for landmark harmonised model of development.⁴

Inland Water Transport cost of cheaper in comparison to roadways and railways and accounting of increasing the surge of business requirement of future the large amount of cargo needed to be transported for India as well as Nepal. Therefore, utilization of NW-1 river water resources becomes transit of logistics co-operations in between two countries.

The Nepal treaty with Bangladesh for handling cargo through railways and Bangladesh treaty with Bhutan the river transport is identified viable party, these treaty was been seek for handling logistics of these countries with support of Indian routes, therefore rail infrastructure have missing links networks and having issues of gauge conversions, these two countries are facing difficulties in handling movement of Nepalese cargo traffic to Bangladesh and Bangladesh cargo traffic to Bhutan. Hence, the IWT networks of NW-1 and NW-2 with integration of Indo-Bangladesh Protocol routes supports seamless movement of trades freights in neighbouring countries.

The Memorandum of Understanding (MoU) have been signed in between these countries, where custom formalities for the movement of goods and crew and their accompanied baggage's under the operating modality and rules have been framed for regulating the same.

The both countries have been agreed and allowed the movement of vessels in India and Bangladesh waterways with equipped necessary radio-telephone for speedy communications, electronic cargo tracking system in conformity with prevailing regulations of the prospective countries.

Both countries have been agreed for Insurance of cargo and means of transport shall be accompanied while movement of the goods through Inland Water Transport modes, under such circumstances the IWT sector facilitates the development of trades and transport in between these countries and facilitates in handling the traffic of Nepal, Bangladesh, Bhutan and Myanmar etc.

Indian railways having geographical linkages have been geographical constraints in offering the Multi-modal transportation of cargo in between the two countries and railways having gauge links issues too, if we explore the possibilities of developing connectivity, therefore railways always involved the investment of huge cost for developing economical transport modes. Whereas roadways links of India have been maintained up to its geographical control's boundaries, whereas the roadways links of neighbouring countries have not been strengthened and the structural weaknesses of roadways infrastructure of neighbouring countries can carry the limited loads to prevent

⁴ Survekshana, Result of fourth quinquennial, Survey on Employment and Unemployment, NSS 43rd Round (July 1987-June 1988) January 1992, Published by National Sample Survey Organization, Department of Statistics, Ministry of Planning, Government of India.

the truck load axel form damage. Hence, lower freight volume may handle and that leads for further economic losses.

The proposed exiting road-based core transit routes in between neighbouring countries of India being followed with several treaties

Route 1	Kolkata- Petra pole/Benapole- Dhaka- Akhaura/ Agartala	India & Bangladesh
Route 2	Agartala- Akhaura-Chittagong	India & Bangladesh
Route 3	Silchar-Sutarkandi-Chittagong Port	India & Bangladesh
Route 4	Silchar-Sutarkandi-Paturia Ferry - Benapole/Petrapole-Kolkata	India & Bangladesh
Route 5	Samdrup Jonkhar (Bhutan) – Guwahati – Shillong – Tamabil-Sylhet-Chittagong	India, Bangladesh, Bhutan
Route 6	Kathmandu-Kakarvita/Phulbari-Banglabandha-Mongla/ Chittagong	Nepal, India & Bangladesh
Route 7	Thimphu-Phuentsholing- Jaigaon/Burimari-Mongla/ Chittagong	Bhutan, India & Bangladesh

(Fig. No.167 List of road routes followed by neighbouring countries for handling logistics for bilateral trades.)

List of Core Railways routes that supports transportation of logistics for bi-lateral trades in between the neighbouring countries.⁵

Route 1	Silchar-Mahisasan/Shahbazpur-Dhaka ICD (Dhirasram)- Bangabandhu Bridge-Darsana/Gede-Kolkata	India and Bangladesh
Route 2	Silchar- Mahisasan/Shahbazpur-Chittagong Port	India and Bangladesh
Route 3	Agartala-Akhaura-Dhaka ICD (Dhirasram)- Darsana/ Gede-Kolkata	India and Bangladesh
Route 4	Agartala- Akhaura – Chittagong Port	India and Bangladesh
Route 5	Kolkata – Petrapole/Benapole – – Mongla port	India and Bangladesh
Route 6	Birgunj-Raxual-Katihar-Singhabad/Rohanpur-Khulna-Mongla Port	Nepal and Bangladesh
Route 7	Jagbani, Biratnagar-Radhikapur/Birol-Parbatipur-Khulna-Mongla Port	Nepal and Bangladesh

(Table No. 38 Details of Major routes)

⁵ Published article by Ministry of Shipping, Achievement of four years

Therefore we know that the ongoing infrastructure development project “Jal Marg Vikas Project along NW-1 (Ganga-Bhagirathi-Hooghly) river system for handling multi-modal transport and logistics system shall contribute the infrastructure sharing for handling the bi-laterals trades and facilitates in development of regional economic development by flourishing the business of associates sectors.

The Inland Water Transport logistics infrastructure capacity building focus for regional co-operations and facilitates initiatives of existing intergovernmental agreements.

5.5 Potential of Bangladesh in perspective of logistics transit regimen.⁶

Bangladesh has tremendous potential to offer and facilitates trades of south Asian countries i.e Nepal and Bhutan, and fast development of Inland Water Transport networks by making huge investments that’s becomes Win-Win situations.



(Fig. No.168 Indicative logistics routes of Bangladesh for handling bi-lateral transit cargo traffic of neighbouring countries)

Integration Diplomatic relationships and trade treaties signed separately with neighbouring countries for the economic development by sharing of logistics infrastructure and facilitating bi-lateral trades.

5.6 Indo-Nepal Treaty for utilization of IWT routes for handling bilateral trades.

India has identified potential of IWT routes in later stage of developments where untapped potential of Inland Water Transport have been developed to contributes towards overall regional economic developments, India-Nepal both countries have been identified trades and transit possibilities through waterways routes, and signed Indo-Nepal treaty by modifying the operating modalities of cargo transportation for the use of Inland Waterways, the trades and transport treaty of 1991 with Nepal have been amended soon

⁶ Standard Operating Procedure Part – II, 3rd August 2015, (Version 1.0.0) for Deen Dayal Grammen Kaushalya Yojna, Ministry of Rural Development, government of India.

to include the Inland Water Transport to increase the shared business of logistics with Bangladesh.

The Indo-Nepal transit in via Kolkata/Haldia shall pass through the following multimodal terminals build along National Waterways -1.

- a) Kolkata/Haldia – Sahibganj (by Inland Waterways); Sahibganj-Manihari (by Inland Waterways); Manihari –Jobbani/Biratnagar (by road)
- b) Jobbani/Biratnagar – Manihari (by road), Manihari-Sahibganj (by Inland Waterways), Sahibganj – Kolkata/Haldia (by Inland Waterways)
- c) Kolkata/Haldia – Sahibganj (by Inland Waterways); Sahibganj – Bhagalpur-Jobbani/Biratnagar (by road)
- d) Jobbani/Biratnagar –Bhagalpur – Sahibganj (by road), Kolkata/Haldia (by Inland Waterways)
- e) Kolkata/Haldia –Kalughat (by Inland Waterways); Kalughat-Raxaul/Birgunj (by roadways)
- f) Raxaul/Birgunj – Kalughat (by road) Kalughat-Kolkata/Haldia (by Inland Waterways)
- g) Kolkata/Haldia – Varanasi (by Inland Waterways); Varanasi –Sunauli/Bhairawa (by road)
- h) Bhairawa/Sunauli – Varanasi (by road); Varanasi – Kolkata/Haldia (by Inland Waterways)

The trade and treaty signed in between India and Nepal for bilateral trade cargo traffic – transit operations and routes where the proposed MMT Varanasi is become focal on strategic linkages, therefore the rise of Inland Water Transport in Varanasi region boost the regional logistics business by enhanced connectivity.

5.7 Indo-Bangladesh Treaty for utilization of IWT routes for handling bilateral trades. Or Treaty for Indo-Bangladesh Protocol IWT routes⁷

The countries of both governments have identified use of their waterways for trade and commerce purposes and agreed the passage of their trade's goods through the geographical boundaries and mutually agreed to utilize the NW-1, IBP Routes and NW-2 for seamless integration of development of water transport infrastructure in the country. The international agreements and conventions have been developed and get agreements signed by the both countries. The practices may be applied transit guarantee regimen for establishing mutual consultation for utilizing inland water transport.

Following routes have been agreed with for PROTOCOL ON INLAND WATER TRANSIT AND TRADE TREATY of India and Bangladesh.

- a) Kolkata- Haldia- Raimongal- -Chalna- Khulna- Mongla- KawkhaliBarisal- Hizla- Chandpur- Narayanganj- Aricha- Sirajganj- BahadurabadChilmari- Dhubri- Pandu- Shilghat.
- b) Shilghat- Pandu- Dhubri- Chilmari- Bahadurabad- Sirajganj- ArichaNarayanganj- Chandpur- Hizla- Barisal- Kawkhali- Mongla- KhulnaChalna- Raimongal- Haldia- Kolkata.
- c) Kolkata- Haldia- Raimongal- Mongla- Kawkhali- Barisal- HizlaChandpur- Narayanganj- Bhairab Bazar- Ashuganj- Ajmiriganj- MarkuliSherpur- Fenchuganj- Zakiganj- Karimganj.

⁷ Working paper "Long Term Perspective of Inland Water Transport in India, by Dr. Status of development of Inland Waterways

- d) Karimganj- Zakiganj- Fenchuganj- Sherpur- Markuli- AjmiriganjAshuganj- Bhairab Bazar- Narayanganj- Chandpur- Hizla- BansalKawkhali- Mongla- Raimongal- Haldia- Kolkata.
- e) Rajshahi- Godagari- Dhulian.
- f) Dhulian- Godagari- Rajshahi.
- g) Karimganj- Zakiganj- Fenchuganj- Sherpur- Markuli- AjmiriganjAshuganj- Bhairab Bazar- Narayanganj- Chandpur- Aricha- SirajganjBahadurabad- Chilmari- Dhubri- Pandu- Shilghat.
- h) Shilghat- Pandu- Dhubri- Chilmari- Bahadurabad- Sirajganj- ArichaChandpur- Narayanganj- Bhairab Bazar- Ashuganj- Ajmiriganj- MarkuliSherpur- Fenchuganj- Zakiganj- Karimganj

The India and Bangladesh government have already agreed on June 2015 for sharing the carriage of inter-country trade and transit treaty of cargo handing on equal sharing basis, both countries have allowed the movement of IWT vessels in their waterways and extended their co-operations for facilitating their international trade's relations in between the neighbouring countries.

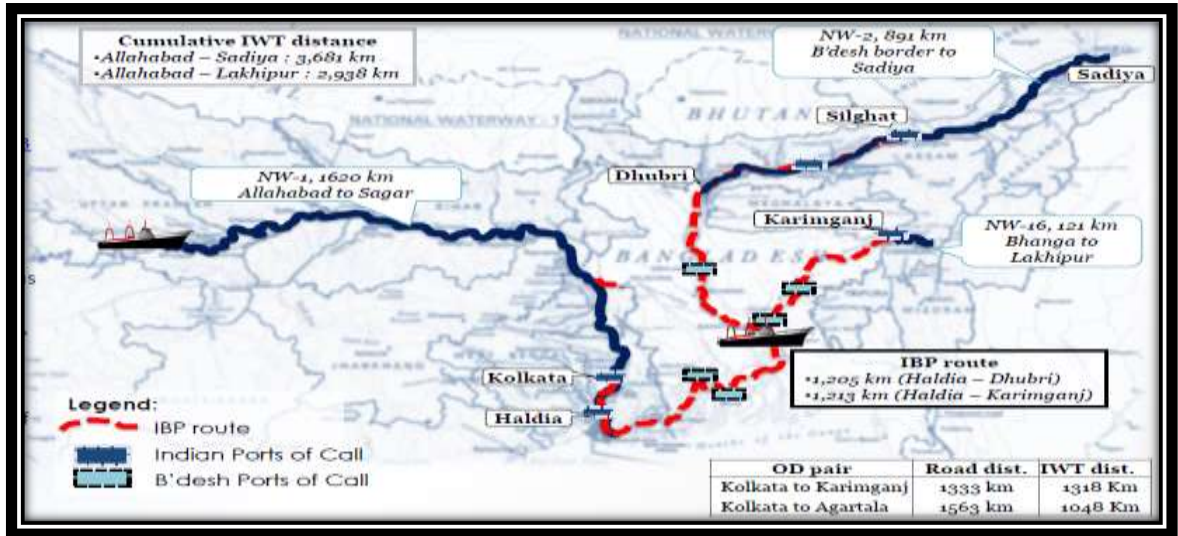
The following ports of call have been agreed in between India and Nepal under water utilization and sharing IWT infrastructure for handling of cargo traffic.

India	Bangladesh
Kolkata	Narayanganj
Haldia	Khulna
Karimganj	Mongla
Pandu	Sirajganj
Shilghat	Ashuganj

The vessels of one country before using the waterways of the other country will obtain the permission of the other country for entry. One country will provide the facilities of "Ports of Call" to the vessels of the other country engaged in inter country trade and number of such Ports of Call will be equal in both countries. Both sides agreed that the following would be treated as 'Ports of Call' in their respective country

India's Strategic Diplomatic Relations with Nepal and Bangladesh and Integrating advantages of two treaties for expanding India's IWT logistics gateways from Varanasi to Dhubri (North East Region) and opens ups opportunity of integrating by lateral trades with neighbouring countries.

The integrating outcomes of the two different treaty on Inland Water Transport taking cognizance of the geographical advantages.



(Fig No.169 Integration of NW-1, IBP Protocol Route and NW-2 for expanding logistics networks in eastern and north east regions and also facilitates bi-lateral trades with Nepal, Bhutan, Bangladesh and Myanmar)

The siliguri called as chicken neck were having huge pressure for handling the cargo traffic and connectivity for the north eastern region for India, only one National Highway and Railways line passes through this corridor hence there is heavy congestion on the routes.

The increasing demand of the region and regional development in the northeast may lead for traffic pressure on Siliguri chicken neck.

The modal shift of cargo from roadways and waterways transport that may help in decongesting the roadways and railways traffic.

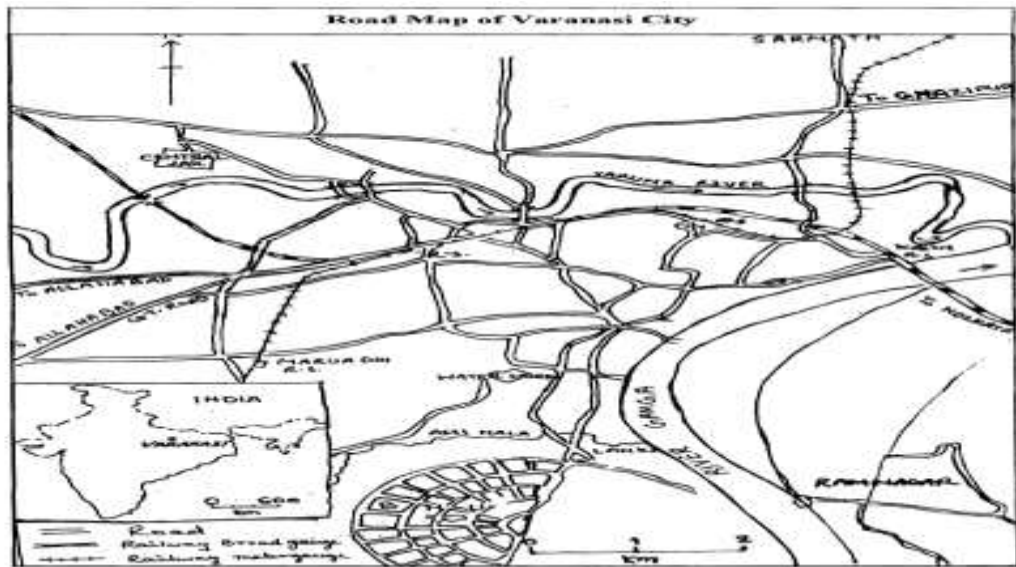
The movement of goods from Varanasi to Agartala via Siliguri Corridor it assume of time consuming more than of 2 days as compared with waterways, hence for diversion of cargo traffic seeking time constraints for the movement of goods in between Haldia and Agartala the model shift prevent cost as well as time.

The rise in development of Inland Water Transport facilities may supports country in building the alternative logistics routes, the development initiatives of IWs and NER and other north east states increase the wide regional connectivity during the flood seasons also and also boost the trade access with neighbouring countries.

Advantages of Integration of IBP Routes with NWs⁸

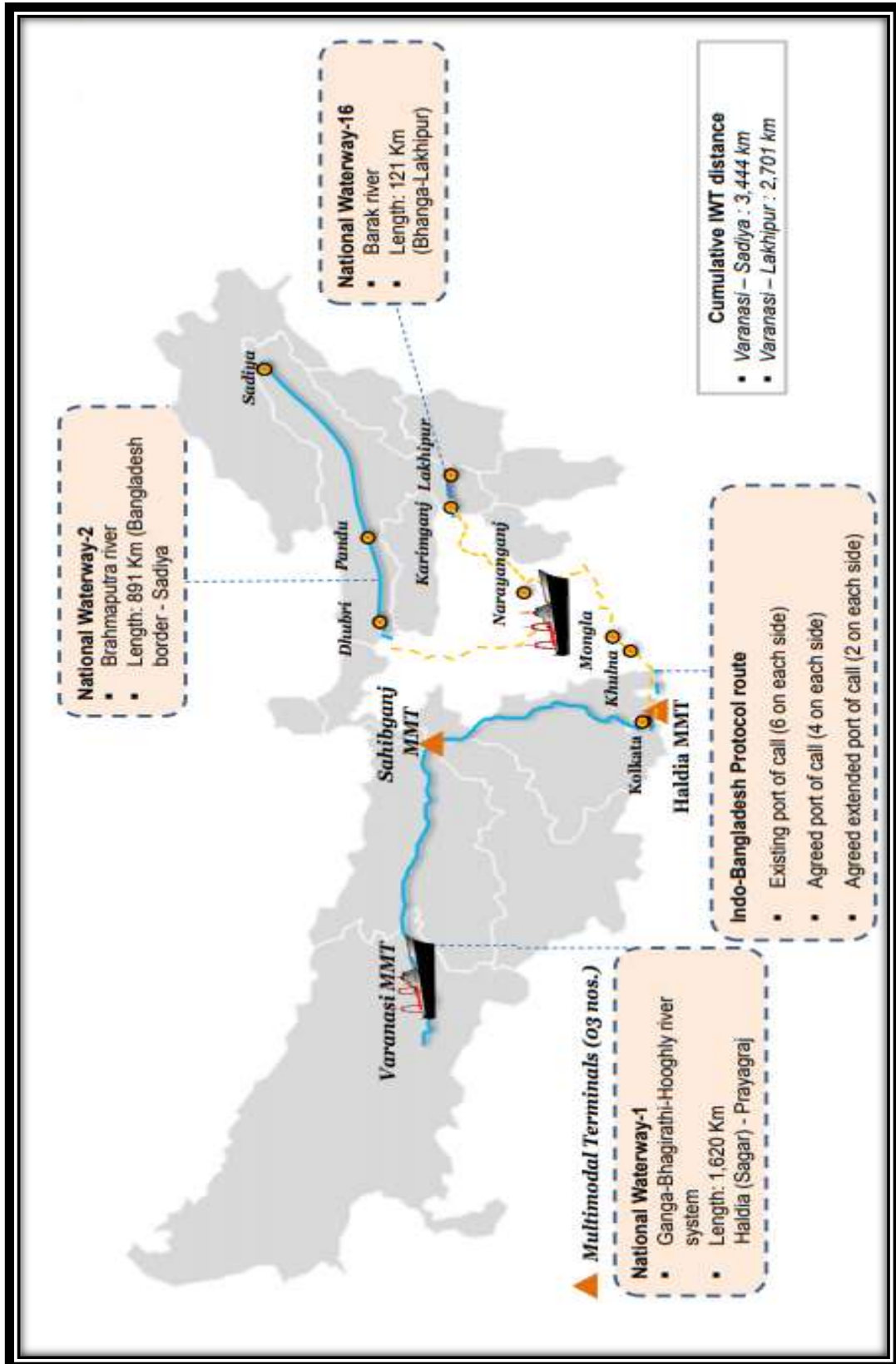
- IBP route connects NW-1 with NW-2 and NW-16, and provides an alternate route to congested Siliguri corridor
- IBP route provides alternate route to congested road routes (LCS) for Indo-Bangladesh trade
- 6 'Ports of call' on either side
 India: Kolkata, Haldia, Dhubri, Pandu, Silghat & Karimganj, Bangladesh: Narayanganj, Khulna, Mongla, Sirajganj, Ashuganj & Pangaon

⁸ District Survey Report, of Varanasi City, Government of Uttar Pradesh



(Fig.no.170. Portrait of Varanasi Roadmap and National Waterways-1)

Connectivity through Waterways



(Fig. No.171 Details of Waterway Connectivity)

5.8 Environmental Benefits for Promoting Inland Water Transport: ⁹

Varanasi being cluster of international importance heritage value, therefore the religion of all communities arrives internationally here, the city has 84 Ghats between Varuna and Assi river stretch and makes the shape of river crescent shape, river water flowing from north to south a rare possibility in the world.

Despite the Varanasi city being congested and also faces threats of floods during heavy rains, but still the city religious sprits are vibrant and can be observed globally.

Inland Water Transport facility are essentially required to provide services to the tourist for enjoying the city from water rides on boats and IWT vessels.

Efficient cargo movement through Inland water barges provides economic and environmental benefits, for establishing any transportation mode there is several impacts have been identified, however in the case of Inland Water Transportation, there is significantly lower impact on transportation is lower impact.

Inland Water Transportation has reflected the lesser fuel consumption and carrying capacity is higher compared than any other modes of transportation, country wide environmentalist has recognised inland water transport environmental impact.

During industrialization and commerce development era the degradation of environment are bigger challenges, the world wide environmentalist has recognised that the major cause of Air pollution is occurs through transport sector. Therefore, under these circumstances inland water transport concept may offers in protection of exhaustive fuels.

Use of Inland water transport for handling commercial freight and efficient utilization for energy benefits to environment by lesser fuels burning and producing lesser noise pollution. As Water Transport is friction less therefore, the utilization of fuel efficiency are very higher.

We can easily conclude that Inland Water Transport system are environmentally sustainable modes of transport, and the degree of fuel utilization and realization of fuel efficiency are higher in the case of Inland Water Transport, As per the research paper published by maritime administration, United States Transport Department, titled Environmental Advantages of Inland Barge Transportation, it shows that shallow draft water transportation arrangement for bulk transportation of freight offers most fuel efficient mode of transport.

Measures of freight energy efficiency (In BTUs per Net Ton-Mile)				
Transport modes		Operating Energy	Haul Energy	Model Energy
Railways	Overall	660	1130	1720
Roadways	Average	2100	2800	3420
Waterways/Barge Transport	Overall	420	540	990
	Upstream	580	700	1280
	Downstream	220	340	620

(Table No. 39. Measures of Freight energy efficiency)

⁹ Website of Knowledge India, Web link: <https://knowindia.gov.in/culture-and-heritage/monuments/kashi-vishwanath-temple-varanasi.php>, dated: 11.01.2020

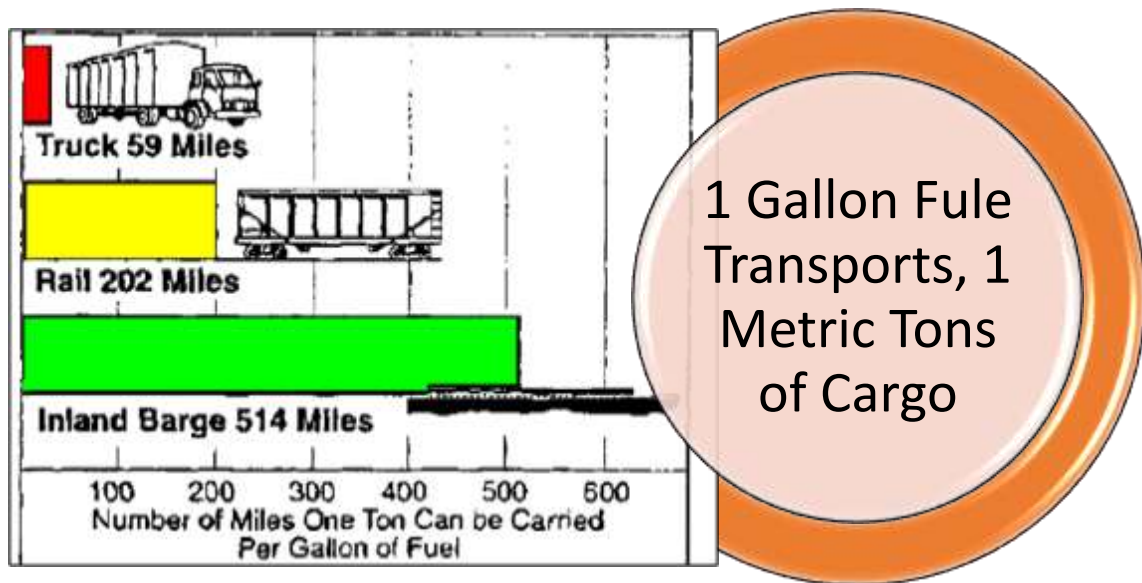
The more studies on Inland Water Transport has been carried out in the advanced countries, where it was concluded that transportation through Inland waterways for larger cargo volume is more efficient and economical.

The energy use for carrying cargo per ton mile compared with railways and roadways are very lesser, the energy cost per ton mile of roadways are at least four times higher than railways and five times higher than waterways.

The Eastman study has been conducted and its outcomes was that relative energy efficiency derived with the cargo carriage capacity with the modes of transport. The inland water barges carries significantly amount of cargo over its barge.

The model comparison of fuel consumption and utilization reveals that IWT mode is choice of alternative modes of transport. The inland water transport barges consumes lesser energy as compared with any other modes of transport.

The energy efficiency with barge transport results in several environmental benefits by reducing the exhaustive fuel consumption in one hand and in another hand it reduces the emission of carbon footprint.



(Fig No. 172. Standard Freight Transportation in Kms/Gallon fuel consumption with different using transportation modes, Source: Final Report, Maritime Administration, U.S Department of Transportation)

¹⁰When we prepare choice for selection of alternative modes of transportation of freight, the calculation of fuel consumption is vital part of shipment planning, one's always facing challenges while shifting of cargo, and cargo transportation modes were shifted where transportation modes offer better fuel consumption efficiency.

¹⁰ Website of BHU, Web link: <http://www.bhu.ac.in/index.php>, dated 11.01.2019

The demand of fuel consumption in transportation sector are increasing day by day, therefore it results in damages of several environmental may occurs. Inland barge transportation results in greater fuel conservation and provides better fuel efficiency by carrying larger volume of cargo quantity. Hence Inland Water Transport being less energy intensive compared with other modes of transport, the cost incurred on tons/kilometres with Inland Water Transport becomes economic intensive and cost effective. It also produces lesser environmental pollutions such as Air Pollution & Noise Pollution etc.

5.9 IWT Energy Efficiency & Fuel Utilization:

Whole world is seeking for obtaining more energy efficient in every activity to safeguards the environmental impact for longer periods of future, therefore when we consider Inland Water Transport fuel consumption and cargo carrying capacity we can easily conclude that barge transportation are having maximum energy efficient by providing fuel savings, as being less energy efficient compared with any other modes of transport on tonnes Kilometres.

The National challenges for conservation of fuels and environment and the concern of transportation sector meeting environmental goals can be met with increasing the utilization of Inland Barge Transportation by promoting commercial freight transportation along National Waterways – 1, Varanasi is located on focal path of freight transportation corridor from Delhi to Kolkata and further north east region, hence there is maximum possibilities of transshipment of cargo at MMT Varanasi and freight may re-routed the Inland Water Transport sector.

5.10 Air & Noise Pollution & Accountability of IWT Sector

Globally, Air and Noise pollutions are considered undesirable role in economic activity and it has aroused public outcry, but salutations become more critical when we see the crowds of cities and their transportation role in mobilize sources in expanding air pollution and noise pollution.

Pollutions are the bi product of transportation sector, there are some more and passive approach has been used in reduction of noise and air pollution in transportation sector.

Varanasi city dwells and towns are very congested, being ancient city, therefore it has narrower lanes and congested paths, and hence everyday city faces higher traffic surge and jams that may leads for burning of fuels and also traffic increase noise pollutions.

The generating sources of Air and Noise pollution is being due to increased traffic movement in the city, the movement of urban traffic and chief offenders of pollutions. Transportation sector emits higher percentage levels of carbon and other Co2 gases emissions.¹¹

Air pollution has caused wide verity of pollutions, the pollutants emit from the burning of fuel from engine caused wide variety of pollutions, man-made and natural sources of fuel consumption and multiple types of pollutant emissions are listed below:

The study was conducted by the US Transport department in St. Louis region, where it was analysed where it was shown that Waterways Traffic has lesser on impact of Air quality as compared with any other modes of transportation.

¹¹ Web Link of Parliament Library, Web link:

http://164.100.47.193/intranet/Development_of_Waterways_in_India.pdf, dated: 12.01.2020

Emission Source	Towboats	Other Transportation	Total Emissions
NOx	3,297	105,932	433,637
THC	939	198,063	295,124
CO	2,101	980,944	3,852,753
SOx	462	7,887	1,234,395
Particulates	198	8,940	354,672

(Table no.40. Annual emission of pollutants & monitoring of air quality, Source: research paper on Environmental Advantages of Inland Barge Transportation, Maritime Administration and US Transport Department)

The another reference study was conducted by the Canadian National Railways, that study has revealed 1,000 pounds of diesel fuel produces 578 cubic feet of major pollutants, composed of: carbon-monoxide (CO)- 123 cubic feet, oxides of nitrogen (NOx)- 337 cubic feet, aldehydes (HCHO)12 cu. ft., sulfur dioxide (SOx)- 12 cu. ft., and hydrocarbons (HC)- 93 cu. ft.¹²

This Canadian Railways Study has concluded that IWT Transport consumes much lesser energy for freight transportation as compared with roadways and railways mode of transport.

Under the examination of vessel operating conditioning and surroundings, it was also concluded that IWT vessel operating conditioning in far away from the populated regions therefore it has also lesser impact on quality on human life.

MODE	HYDROCARBON	CARBON MONOXIDE	NITROUS OXIDE
TOW BOAT	.09	.20	.53
TRAIN	.46	.64	1.83
TRUCK	.63	1.90	10.17

(Table. No.41 Emission of pollutants, release by various transportation modes, while moving of per ton cargo over thousand miles) Source: United States, Environmental protection agency, emission control Lab)

Nation wide for transportation of freight the railways and waterways modes of transports are preferred, much of freights are moved internationally through maritime transport, however unfortunately Inland Water Transport sector was neglected and lesser publicized.

¹² Research paper on Environmental Advantages of Inland Barge Transportation, Maritime Administration and US Transport Department

The contribution of waterborne commerce to the economy is significant and may establishment and civilizations in past are developed along the river banks and their all types of needs are fulfilled through river water resources.

Utilization of water resources for transportation purposes is win –win situation for Indian economy, the most of advanced developed nation has realized the potential of inland water transport in optimizing utilization of country resources to its maximum extent.

But unfortunately, previous governments have supported very lesser investment in development of water transport facility, due to lack of availability of funds in water transport development are significantly affected its development.

The present government has realised the potential and benefits of water transport facility, and developed Jal Marg Vikas Project along National Waterway-1 for augmenting river transportation infrastructure from Varanasi to Haldia 1380 Km of river stretch with technical and financial assistance of World Bank, Govt. extra budgetary resources and PPP investments etc.¹³

The damaged to the environment in barge transportation are depend upon morphology of river to river and operating conditioning of overall voyage, however the overall benefits are noticed in case of Inland water Transport is positive for environmental safeguards measures.

The study's findings and analysis of its contours in case of NW-1 in India the model shift of cargo from other modes of transport to waterways for transporting bulk cargo benefits significantly in terms of environmental protections.

The transportation of bulk commodity with waterways is environmentally compatible and provides sustainable means of transport, the IWT sector offers several benefits like lesser emission of exhaustive gases, less probability of accidents, reduced traffic congestion, lesser fuel consumption, lesser disruptive to the society and environmental friendly and sustainable modes of transport.

5.11 Inland Water Transport offers flood control and wild life protection

IWT factored to develop Navigational channel that offers wild & aquatic life protection, flood control, public water supply, irrigation management, Industrial use and monitoring of sewage waste & discharge and overall economic development of the region.

Varanasi region is already having kasha turtle sanctuary area, where government has declared eco-sensitive zone and the site is culturally heritage site. In addition of utilization of Inland Water Transport offers millions of beneficiaries and advantages of commercial freight and passenger transport operations

The co-incident benefits the Varanasi city have where Inland Water Transportation is required to de-congest the city, monitor the activities of city sewage discharge into the river, protecting wildlife turtle and other aquatic animals etc.

The Inland Water Transportation development in Kashi region played major role in integration of rural economy with main stream of the city, the IWT enhanced connectivity within the Varanasi region in minimal possible time and leaser cost with sustainable

¹³ Website of World Bank, web link: <https://www.worldbank.org/en/news/feature/2011/09/23/india-transportation>, dated: 12.01.2020

environmental benefits. This sector has played pivotal role in development several rural sections of trades directly to the city cores and supports in generation of various economic activities.

The development of Inland Water Transport facility results in creation of employment opportunities and increase income of populations, the water transport has good environmental impact on society, the provision of building navigation channel in mid of the river monitor the flow of the river, therefore during high flow level the river water prevented from staggering and flow may be smoother in longer runs.

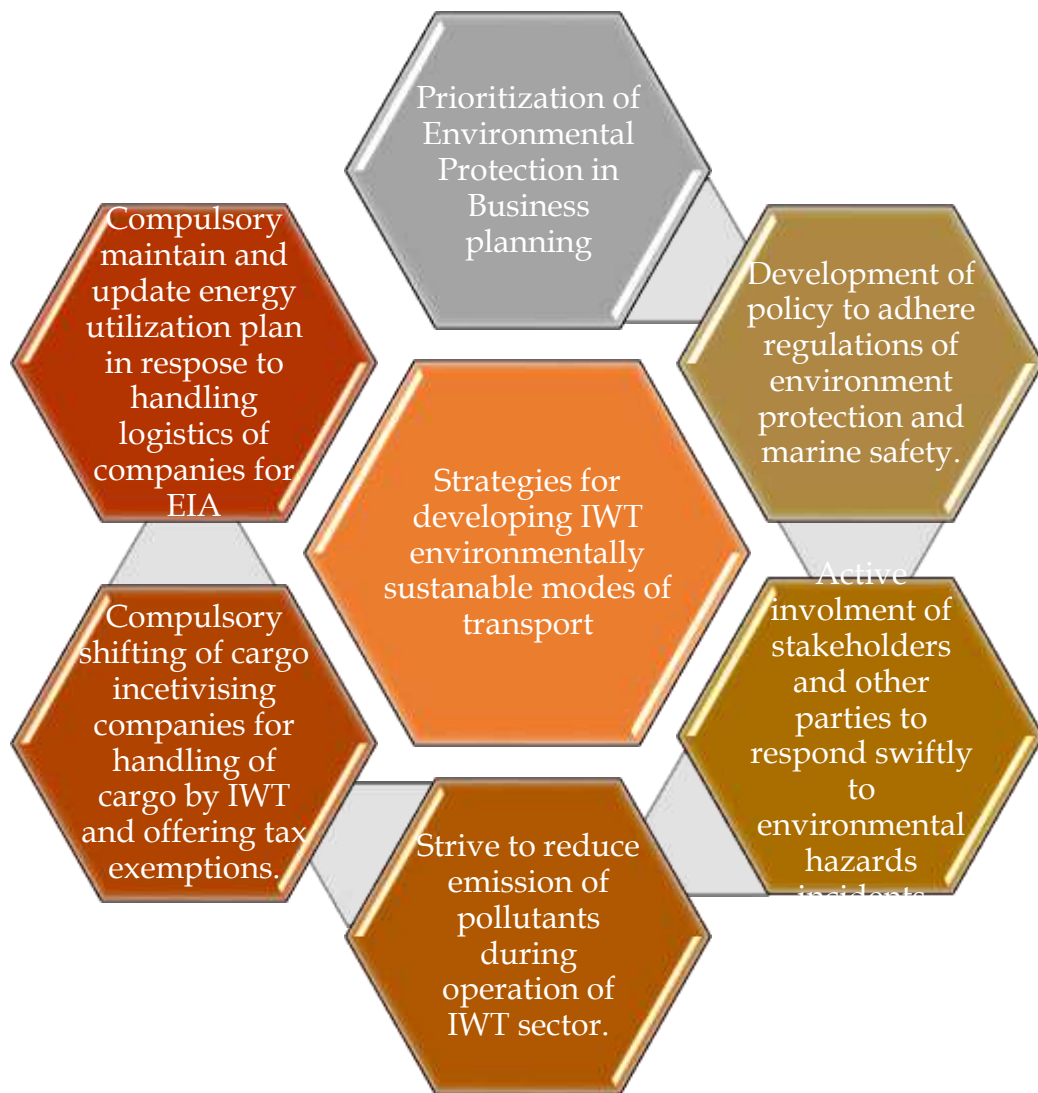
Monitored flow of river, several river conservancy works may carried out such as bank protection, bandalling and prevention of soil and banks erosion etc. impact to prevent the environmental damages, it also enhance in providing flood control, allow smooth transfer of water from one area to another and acting as spur of economic activity in Gangetic region.

The increasing demand of national environmental protection, and commitment of government of protecting the environment and restoration of natural resources and better land utilization, the commitment to the primary concerns are required to promote Inland Water Transport utilization in the country. ¹⁴

The environmental damages protection and prevention measures are important pillars of sustained economy over longer runs, the corporate ventures of future needed to address veracious challenges, the strong environmental stewardship and commitment needed for improving transport operation in environmentally sustainable modes, therefore, the efforts are needed to eliminate environmental incidents and reduce environmental hazards etc.

Fundamentals are needed to establish to make Inland Water Transport committed for environmentally sustainable.

¹⁴ Website of Energy Technology Network Web link: https://iea-etsap.org/E-TechDS/PDF/T15_Rail_Infrastructure_v3.pdf, dated: 12.01.2020



(Fig. No. 173 Strong Environmental Measures and Effective Conservation of Natural Resources)

5.12 IWT Environmental Measures taken by Inland Waterways Authority of India during Movement and Playing of Inland Vessels through Kachhua Wildlife Sanctuary at Varanasi:

Varanasi city is blessed with flow of river Maa Ganga in crescent shape from south to north direction, the Kashi city is blessed with multiple socio-economic activities happening the region specially along the Ghats of river Ganga, in previous sections of this research thesis the disclosers have been already made, here one more additional blessing are identified the availability of Gangetic turtle in Kashi.

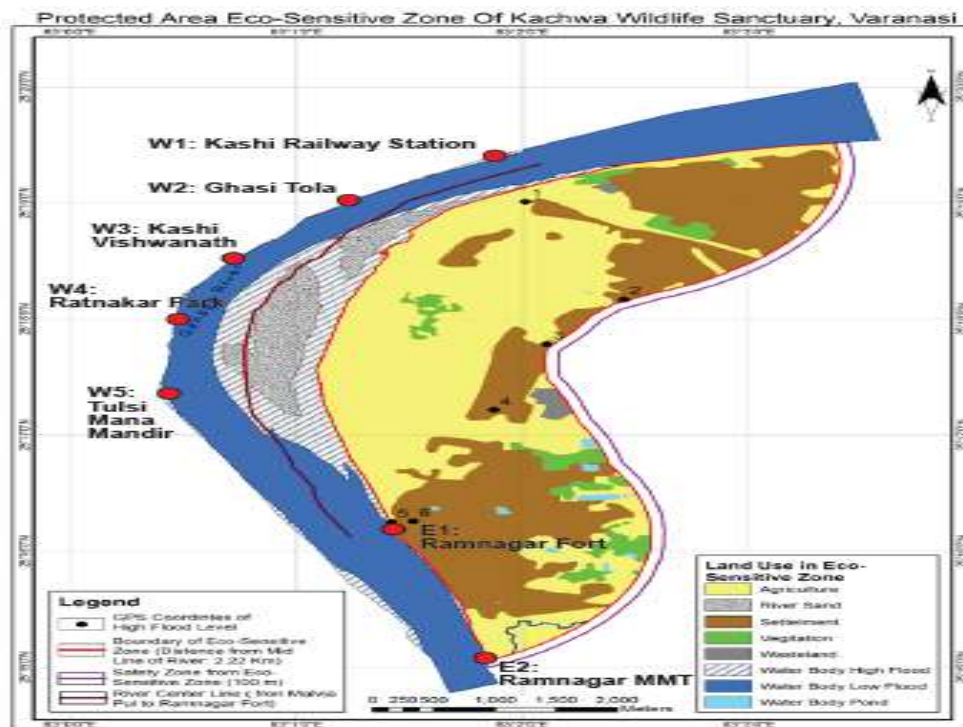
The approximate 7 Km of stretch of river the existence of Kachhua Sanctuary availability are found (Ramnagar fort to Malviya Setu) the area of this river stretch are declared as Turtle Sanctuary. The area is administered under State Forest Act Section 3, Part-4170/14-3-62 dated. 21.12.1989.

This site is world protected and dedicated site of fresh water turtle, the river Ganga is habitat of lots of aquatic species, turtles, Ganga Dolphin and numerous of birds etc.

Varanasi seven kilometre of stretch of the river is echo sensitive zone, and right bank of the river is habitat of breeding turtle, therefore motor boats etc. activities are restricted.

In development of water transport facility the government agencies and water transport administering authority i.e IWAI, Ministry of Ports, Shipping and Waterways has prepared detailed study on preventing environment during operations of Inland Water Transport system in Varanasi region and entire stretch of National Waterway -1

The government efforts is always focus to minimize environmental impact while developing sustainable modes of water transport facility at Varanasi region. the IWAI has responded to the wildlife protection and forest authorities regarding operating conditioning of IWT vessels in the river and damages may incurred in the areas of eco-sensitive zones.¹⁵



(Fig.No. 174. Notified area of Kashi Turtle Sanctuary by the Govt. of U.P)

5.13 Best practices adopted by IWT Authorities while operating of vessels

Best practices followed during construction and use of protective equipment's to prevent fall of pollutants in the river during construction phase of IWT infrastructure.

The regular removal of sand and siltation from the banks are required, regular cleaning up of the bank and floods waters are recommended to best used

Integration of vessel to use propeller mesh cages to protect aquatic fauna and turtle, dolphin and fishes from the damages.

¹⁵ Notification of Kashi Turtle Sanctuary by the Govt. of Uttar Pradesh.

The sound and noise study impact to be implemented regularly, Ganga dolphins and other aquatic animals are very sensitive, therefore environmental protection activities needed to be strengthened.

The movement of vessel in the sanctuary is restricted only to 7:00 hrs to 9:00 Hrs to minimize impact on foraging dolphin and basking and nesting turtles.

Speed limit of vessel in the sanctuary should be kept within 5 Km/Hrs. as recommended by forest department/WII

Ensuring that no effluents or solid waste is to be discharged made by the vessel in the river, the vessel needed to be moved in fixed and pre-determined channels only to prevent lesser impact on wildlife.

The vessel birthing is not allowed in sanctuary area, the protection and mitigation measures to be adopted as per the guidelines ensured Govt. of India and ministry of environment forest and climate change.

No quarry/mining activities are allowed in the area of sanctuary and IWAI ensure all possible ways for protecting the wild life sanctuary.



(Fig: 175 Picture of Turtle in Kahhuwa Sanctuary at Varanasi)

5.14 De-notification of Kashi Turtle Sanctuary by the Government of Uttar Pradesh: 16

Inland Water Transport Project is being called under the pressure of environmentalist, as in one hand government has challenges over to make India sustainable in logistics performance through waterways and in another hand several pressures of environmental challenges exit in developing navigation in river Ganges.

The Kchhuwa Century is located and maintained by the government in densely located stretch of the river Ganges, therefore government had reviewed the objective achievement of Kachuwa Sanctuary with State Board of Wildlife.

Now post study and expert advice and overseen the facts that notification of Kashi Turtle sanctuary is not meeting its objective, the presence of turtle is there but their reproduction and breeding's are made in the other than defined locations also.

¹⁶ Published report on Early History of Water Transport, Chapter 3, available at Shodhganga, dated 01.02.2020, Weblink:
https://shodhganga.inflibnet.ac.in/bitstream/10603/66419/10/10_chapter%203.pdf

The sanctuary is the part of 1620 Km of National Waterway-1 and Jal Marg Vikas Project is funded at cost of 5369.18 Cores, therefore India needed to complete wipe the introduction of Wildlife Protection Act in the areas of Kashi Turtle Sanctuary.

The chief conservator of forest Shri. S.K Awasthi on 5th September 2018 and authorities Sh. Manoj Khare, District Forest Officer Kashi Wildlife Division in their 8th Meeting, they have submitted the proposal for de-notification of Kashi Turtle Sanctuary.

The decision was taken into the consideration by the State Wildlife Board on 30th August 2018 and after due-diligence the proposal was exercised, the government has selected the upper stretches of river Ganga for shifting of Kashi Turtle Sanctuary.

The study has revealed that 13 different types of species of turtle are found in the adobe of river Ganga, the Gangetic turtle found in the Varanasi region are carnivores, the Ganga Ghats are performing funerals of thousands of dead bodies are these turtles eats the human dead body remains after crimation by Hindus. Hence looking upon several facts and causes of presence of turtle these sanctuaries are planned to be shifted.

S.N	Common name	Species	IUCN Classification
1	Self-shell turtle	Aspederetes Gangeticus	Vulnerable
2	Indian flap shell turtle	Lissemys Punctate	Low risk
3	Narrow headed soft shell turtle	Chitra Indica	Endangered
4	Spotted pond turtle	Geoclemy Shamiltonii	Vulnerable
5	Crowned river turtle	Hardella Thurjii	Vulnerable
6	Indian roofed turtle	Pangshura Tecta	Lower risk
7	Indian tent turtle	Pangshura Tentoria	Lower risk
8	Tongoka	Balagur Dhongoka	Endangered

(Table. No.42. Major List of Turtle Species are Found in Varanasi Region, Source: Kashi Wildlife Division Office and IWAI Office)

5.15 Social benefits perspectives developing riverine or Inland Water Transportation sector at Varanasi City/Rural regions. ¹⁷

Rivers are widely associated for providing social benefits to the large extent of populations, many socio-economic and cultural parameters available that are impacted by the development of Inland Water Transport Sector at Varanasi region.

The focus group discussion was conducted with local stakeholders such as local commuters, residents, boatman community, fisher man community etc. during interactions the key benefits and public opinion was gathered by dialog process and tried

¹⁷ Website of ipfs, Web link:

https://ipfs.io/ipfs/QmXoyypizjW3WknFjInKLwHCnL72vedxjQkDDP1mXWo6uco/wiki/List_of_National_Waterways_in_India.html, dated: 15.03.2020

to capture facts on social –economic impact on development of Inland Water Transport facility at Varanasi.

The baseline survey was conducted and that appeared true in respect for the Varanasi city, during stakeholders’ discussions the religious significance was also discussed.

The local population believes on nirmalta and aviralta of river Ganges and development of water transport project may offers benefits to them in many possible extent.

To map the stakeholder’s perception first the potential stakeholders are identified and thereafter the perception of those stakeholders are mapped based upon the background, understanding, circumstances and possible opportunities. Further, attempt has also being made to identify barriers and foreseen opportunities associated with development of Inland Water Transport facility.

Primarily the stakeholders selected for social impact assessment of developing Inland Water Transport in Varanasi city.

- a) Local Industries
- b) Govt. institutions
- c) Traders and Businessman
- d) Tourist operators
- e) Boatman community
- f) Religious institutions
- g) Local and Regional populations
- h) Fisherman community
- i) Other

The broader perspective of local populations was captured and categorised related to the development of Inland Water Transport facility.



The discussion on socio-economic impact on development of Inland Water Transport was discussed with communities’ i.e boatman community, fishing community living along the bank of river Ganges.

The communities living very close to the river side are utilizing maximum and frequently the benefits of river transport facility, however, in macro-economic perspective the whole region is coming to be benefitted by the development project.

Most of stakeholders agreed that IWT will enable them in access of many benefits of already available infrastructure to the opposite bank of the river.

During focus group discussion with local populations several responses have been gathered where public crosses the river for healthcare, education, employment and other official purposes.

5.16 Inland Water Transport eliminates gaps of geographical divide in between Varanasi and Chanduali district ¹⁸

Considering the geographic location of Varanasi region, the river Ganga has divided two district Varanasi and Chandelle.

The Varanasi city is located on western bank where all urban facilities are already developed and most of social –infrastructure are already developed such as Healthcare facility, university/colleges, religious institutions, employment possibilities, marketplace for trading of goods and services, court and government offices etc.

Therefore, it is clearly indicated that development of Water Borne Transport project at Varanasi will reduce the geographical divide and enabled and sustained water transport facility, provides seamless and reliable connectivity options to the regional populations.

Presently three bridges are developed at Varanasi over river Ganga, but increasing demand of city and rising vehicular populations are creating many problems such as congestion, air pollutions, longer time taken for travelling shorter distance and other traffic issues etc.

Stakeholder’s reasons of crossing river Ganga at Varanasi

The 150 sample interview was conducted along the Ghats of river Ganga at Varanasi, the main aim of survey was to figure out the social demand aspects related to the Inland Water Transport.



(Fig. No.176 Stakeholder’s reasons for crossing the river)

Inland Water Transport sector reduces congestion on roads at Varanasi city, IWT is most significant transport that reduces distance, time and cost of travel within the city, the

¹⁸ Website of Archinomy (dated 10.11.2020)
<https://www.archinomy.com/case-studies/varanasi-waterfront-study/>

vehicular movement on roads has created traffic jams problem in the Varanasi city, and potential introduction of IWT services at Varanasi city offers safety and cost as compared with roadways modes of transport.

The traffic threshold of Varanasi city increases and impacted negatively and curtails peoples and goods, waste valuable energy resources, increase personnel trips timings. Impairs productivity, creates social tension, and damages the environment.

The traffic congestion increases the probability of accidents, with attendant injuries and/or deaths, Accidents and environmental damage tend to be most serious where heavy traffic either moves at high speed or is locked in congestion

The Introduction of Inland Water Transport facility at Varanasi meets up additional cargo demand transport requirement, building more towboat of the same size, but fewer one with greater horsepower that are capable of navigating more number of vessels.

IWT Sector enhance land use and social impact.

Inland Water Transport facility operated along the banks of river and flowing waters of river, most of the banks of waterways are isolated and land utilization is limits due to constraints of availability of infrastructure, strengthening of IWT infrastructure facilitates, rail lines passing through major urban areas. The inland water transport facilitates large barge transport and relatively and frequently supported river transport operations, Inland water transport offers safe and smooth bank to bank connectivity along the National Waterway-1, whereas, the roadways modes of transport has impaired with huge social cost such as Air, Noise, Health and Accidents related cost.

Social Cost Matrix of differentiated modes of transport ¹⁹

The cost assessment of various modes of transport was analysed during primary stakeholder's survey at Varanasi and case study of European Transport study was co-related with Varanasi context.

The Social cost benefits assessment among all means of transport has been more as compared with Inland Water Transport, the transport social cost such as air pollution cost, noise pollution cost, land coverage cost, construction, maintenance and operations cost and accident related cost etc. among major modes of transport benefits are compared with cost incurred on major five broad categories.

Inland Water Transport has least environmental and social impact, in three of the categories, viz. noise pollution, accidents, and land coverage,

¹⁹ Website of Inland Water Transport division - <http://shipmin.gov.in/division/iwt-1> Ministry of Shipping, Government of India

Water transport had little or no impact. Therefore, the Inland Navigation has selected as most preferred modes of transport.

SOCIAL COSTS	AIR	RAIL	INLAND WATERWAYS	ROAD	TOTAL
AIR POLLUTION	2	4	3	91	100
NOISE POLLUTION	26	10	0	64	100
LAND COVERAGE	1	7	1	91	100
CONSTRUCTION/ MAINTENANCE	2	37	5	56	100
ACCIDENTS/ CASUALTIES	1	1	0	98	100
TOTAL IN BILLION DM/YEAR	2	14	2	67-77	100

(Table. No.43 Social Costs in Relation To Transport Modalities, Source: Research Paper on Environmental Advantages of Inland Barge Transportation, U.S. Department of Transportation)

Inland Water Transport Facility offers mobility and promotes improved access of broader access of socio-economic opportunities through transportation sector

The underdeveloped IWT sector at Varanasi city facilitates low-cost transport to the public, with reduced distance and time savings options, the urban municipal corporations have developed framework models for strategic investment in developing city transport infrastructure, for public safety, comfort, cargo transportation and also offers venerable passengers.

5.17 Linkage of Inland Water Transport with Socio-Economic Activity: ²⁰

Inland Water Transport promotes low carbon transportation in India, the Inland Water Transport facility at Varanasi best integrated transport with socio economic aspects.

²⁰ Website of Knowledge India

Web link: <https://knowindia.gov.in/culture-and-heritage/monuments/kashi-vishwanath-temple-varanasi.php>, dated: 11.01.2020

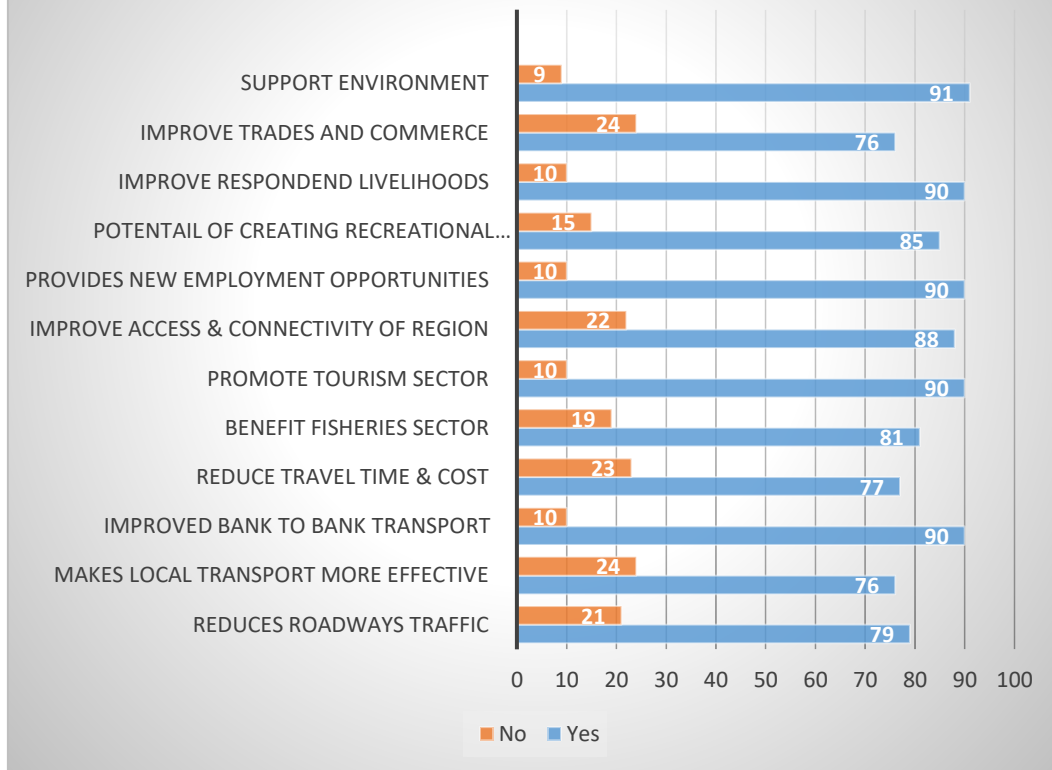
Socio-economic aspect	Linkage with transport
Income poverty	Lack of access to work for women exacerbates income poverty
Expenditure	Transport expenses crowd out other expenditures in household budgets, often pushing women to walk long distances and compromise their health and education
Lack of capabilities	Lack of access to social services is a deterrent to improving capabilities, more so for women than men
Lack of functioning	Due to lack of access to employment opportunities, health care, education, etc. This is more pronounced for women in a patriarchal set-up
Time poverty	Due to inappropriate transport paradigm, which emphasizes mobility but not accessibility and causes fatigue and unfavorable time allocation for women, who are either forced to walk or wait for cheap public transport if available
Energy poverty	Caused by the need to walk long distances due to unaffordable transport options
Safety poverty	Caused by to lack of safe walking and cycling infrastructure, which also impacts access to and from public transit

(Table No.44 Sensitivity of Inland Water Transport at Varanasi and its associated linkages with Socio-Economic aspects)

At Varanasi city Inland Water Transport facility improved the access of broader socioeconomic opportunities by providing low-cost transport solutions to the all sections of the society, transportation is basic needs and it required daily to access various services, performing jobs, business activity, and also integrated with social mobility factors such as affordable means of transport facility. The Inland Water Transport facility supports development of human kind all around at Varanasi Region.

Primary survey was conducted across the river bank with prospective stakeholders such as tourist, local public, country boat operator, fisherman, religious groups etc. total 150 random sample has been taken and close focus group interview was conducted and tried to find the socio-economic benefits possibilities are associated with development of Inland Water Transport facility at Varanasi.

Stakeholders Perception Survey for IWT Sector Development at Varanasi



(Fig No.176 Details of Stakeholders Perception Mapping at Varanasi for Inland Water Transport)

Water Transport has interestingly gain the faith of its stakeholders at Varanasi, the impact on development of water transport at Varanasi is directly reflecting in the form of local populations beliefs and its stakeholders possible positive responses

The IWT Sector has achieved remarkable supports by their stakeholders in all twelve parameters of assessment. The sector has potential for generating employment, positively impact livelihood of boatman and fishing community, provides trades and business opportunity to the common public, supports regional transport development and offers ease of connectivity across the bank.

River Ganga has religious sentiments and Varanasi is centre of tourism due to various reasons, therefore the respondent have also perceived that if IWT services are developed in the region the more number of tourist foot fall will exist at Varanasi city.

Further social research investigation has been carried out with that set of stakeholders with dialogue mode and tried to identify the comparing benefits of Inland Water Transport with other modes of surface transport such as railways and roadways.

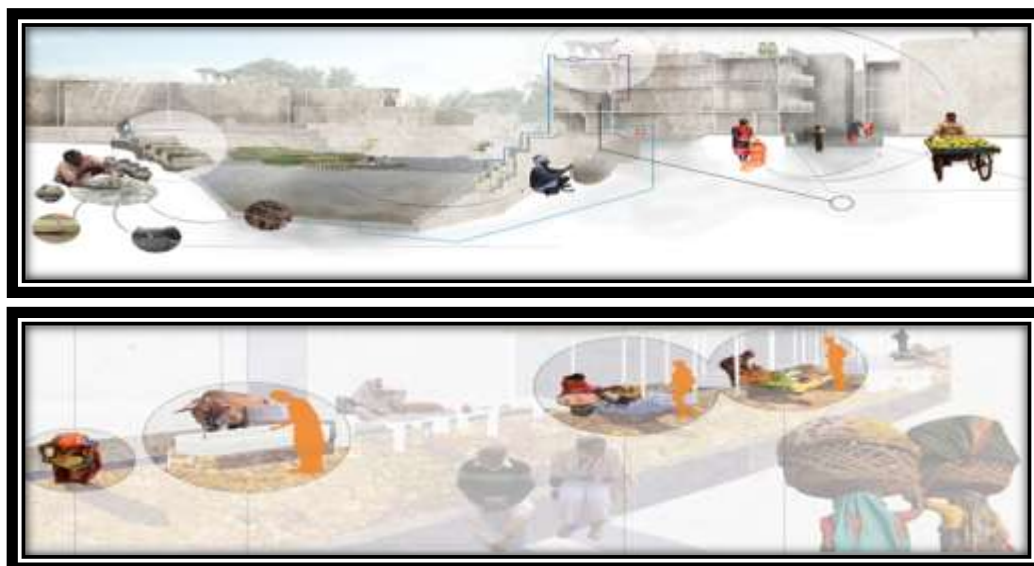
Mean Weightage % of Stakeholders perception for transport selection	Railways (%)	Roadways (%)	Waterways (%)
Safest mode of transport for daily commuting to Varanasi	32	38	30
Time & cost-effective mode of transport for city commuting	30	30	40
Requirement of capital investment for Transport	40	40	20
Your preferred modes of transport for crossing river	4	19	77
More appealing mode of transport at Varanasi for urban commuting	24	25	51

(Table No. 45. Mean Weightage Percentage of Stakeholders Perception for Transport Selection)

During perception survey with prospective stakeholders of water transport, most of the responses having secured higher mean weightage percentage in favour of water transport facility development.

The development of water transport facility at Varanasi offers several economic benefit to the Varanasi city, the IWT transport facilitates in development of Haat's or Small Marketplace for local subsistence farmers and handicraft persons.

The establishment of commercial shops along Ghats provides boost in economic development of the Varanasi region.



(Fig. No.177 Establishment of Haat's and Local Bazaars along the Ghats of Varanasi city, Source: Water Urbanization report of GSAPP Columbia)

The local market at Varanasi city transactions takes place in very informal ways, and in earlier sections we have studies that how exiting logistics systems affecting regional trades of the city, therefore development of urban water transport facility at Varanasi helps in managing transport transaction more efficiently and provide opportunity more forward and upward mobility to support urban economics.

5.18 Inland Water Transport Transacts Exchange of Resources between Society and Environment ²¹

Varanasi city is focussing on opportunities of interventions that adopted to scale up the multiple economic development of the region to benefit society at large.

Development of water transport facility to the city not only support for urban transport but constantly restoring the cultural habitat and heritage of the city.

City are known for pilgrimage and annual spiritual events worldwide, the current infrastructure needed changes and development of logistics matrix with integration of exiting modes of transport with water transport facility maximizing the local resource utilization and support in building community ecologically and socially balanced.

Thousands of people from India come to Varanasi each year to be cremated on Manikarnika Ghat after their deaths therefore Varanasi Ghats has active crimination sites throughout the year, hence the development of IWT transport supports these crimination activity by facilitating by providing logistics for dead body and firewood transportation.



(Fig. No. 178 Picture of IWT routes facilitates logistics for crimination activities at Benaras City)

²¹ Website of Wikipedia, Web link: https://en.wikipedia.org/wiki/Kashi_Vishwanath_Temple#Legend
Dated: 11.01.2020

Chapter 6

Research Conclusion:

6.1 Summary of Conclusion:

The objective of developing Inland Water Transport System along National Waterway-1 (Ganga – Bhagirathi-Hooghly) river system is to strengthen local and national economy by enhancing logistics infrastructure facility in the country.

IWT sector has potential for creating mass impact on passenger and freight transportation and utilization of Ganga River front effectively supported additional economic benefit for complete revitalization of local economy of Varanasi region.

Inland Water Transport sector is struggling for development at present stage, but not least this mode of transport possibly shifts the market share of transport to waterways, as we all know that Varanasi city is blessed with the presence of river goddess Ganga flowing adjacent to the Varanasi city, therefore the government has emphasised for developing well managed mass transit system for public transportation by IWT mode.

Secondly, the IWT mode is eco-friendly mode of transport when it was used with alternative source of fuel, hence this sector is always economically viable and meet emission standards to manage mass public transportation by protecting environmental damages.

For urban community's river transportation are used since long ages, the introduction of various type of water craft have been already placed into the river, however, the waterways transportation modes are being older transport but due to invention of roadways and railways technology and infrastructure, the most of economic activities have been designed by putting emphasis of their use, somewhere water transport development and its realization of potential was neglected in our county.

Varanasi, is the fifth largest city of Uttar Pradesh and its home of approx. 2 million of peoples as per the census of 2011, the city has historic urban and newer settlement which is parallel to river transport, Varanasi is dense settlement pattern of narrow streets, mixed –use neighbourhood where industry and commerce are intertwined with residential use, and commerce are intertwined with residential use and religious destination woven into the confines of a tight urban fabric.

The physical growth of Varanasi city is extended along the roadways and railways infrastructure and supported allied commerce opportunities; Varanasi city is the most active area in Varanasi district. Several settlements are distributed in the eastern side of Ganges River, Major railway and roads are attractors for economic activities. City is known internationally for religious centre and domestically for its well –known silks, essential for every wedding in India.¹

Development of alternative modes of transportation system at Varanasi may lower the stress on current modes of transport, it supports in stimulating economic drivers of the city, development of Inland Water Transport facility at Varanasi stimulating new economic growth in the region.

The development of Inland Water Transport facility potentially meets the responses for regional growth in lower vehicle ownership per capita with lowest available surface.

¹ Website of Knowledge India

Web link: <https://knowindia.gov.in/culture-and-heritage/monuments/kashi-vishwanath-temple-varanasi.php>

Date: 11.01.2020

6.2 Urban characteristics of Varanasi city:

The urban settlement of Varanasi city is categorised in to 3 category such as New Peripheral Area, Central/Old historical core of city, rural settlement of Varanasi. The density of population are major attractor of transport demand generation, the transport network must serve this diverse user set in a mutually beneficial means.

Development of alternate modes transport i.e Inland Water Transport enhances land utilization, transport network, market development, education, healthcare centre, silk production areas, hotels, dharamshalas and tourist destination/heritage areas.

6.2.1 Varanasi Smart City Plan & Development of Urban IWT Transport:²

The State Governmnet has outlined development of Varanasi city with having vision and goals of improving quality of life of local public by strengthening of logistics and transportation system.

The several plan/goals and overall objective of smart city is depend upon development of Inland Water Transport system at Varanasi city.

Key Role of IWT Mode of Transport for Smart City Development	
Inland Water Transportation Management	Improve tourism and quality of life of local citizens
	Promotes Integration of Multimodal IWT transport through Roll on and Roll off and Ferry services with roadways and railways modes of transport
	Development of multimodal transport system for urban mobility by improvement of a mass rapid transport and public transport
	IWT facility enhance mobility traffic in the city, offer effective traffic management
	Explore alternative mode of transport

(Table No. 46. Key Role of IWT Mode of Transport for Smart City Development)

The development land use and master plan indicated planned growth for commercial growth areas and industrial use, streets radiating from the core indicate planned growth areas for commercial growth surrounded by residential.

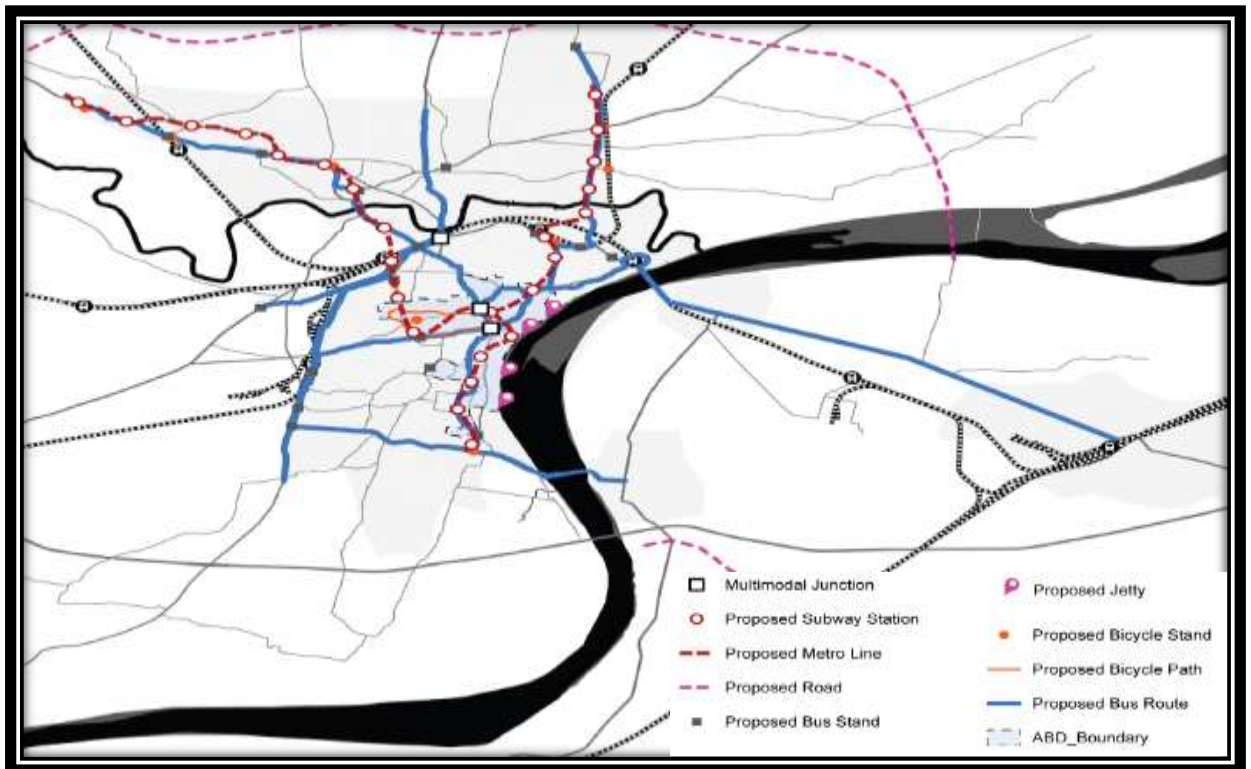
The Varanasi city has long term plan of development of metro facility and integration of inland water transport facility, that become key part of planning for future development, the city commuters may be encouraged for using IWT mode of transport for commuting city unlike metropolitan city.

² India Smart City Mission Report, Municipal Corporation of Varanasi, Uttar Pradesh and Ministry of Urban Development, Government of India

6.3 Possibilities of developing integrated modes of transport at Varanasi city:

Railway lines mainly passes through north Varanasi and connect Varanasi and Mughalsarai by crossing the Ganges River, while roads extend from the riverside to BHU and Kashi station. The proposed metro lines connect several busy and important sites like BHU Godowllia, BHU Cantt whole proposed bus routes try to cover whole Varanasi city and the eastern settlements like Mughal Sarai and Ramnagar.

Varanasi city is one of the oldest living city in the world and home of many ghat, temples, kunds and heritage properties that draw thousands of visitor annually. Varanasi city infrastructure revitalization has added value to the life of common mam, the redesigning of public spaces made ease of life of common people and become inspiration of development.



(Fig.No.179 Integration of proposed metro lines, proposed roads and railways lines with Inland Water Transport nodes)

6.4 IWT development enable Commercial and Land use of riverfront at Varanasi ³

Varanasi is centre of trades where commercial centre, retail estates and wholesale, handicraft and silk production area etc. is planned industrial use. The city has world class academic and healthcare infrastructure, most of colleges and hospital were located in the west and northwest of Varanasi along major transport nodes.

The development of Inland Water Transport facility facilitates utilization of commercial and land use of river front, the riverside are most popular area where local residents and tourist visit and developing water transport facility.

The present transportation profile of Varanasi city reflect evolution highly variegated informal para-transit transport services in the city, most of travellers of the city has stated by satisfying diverse use of their travel budget (reflecting larger metropolitan economic realities) and limited by physical settlement.

The city has high demand of visitors visiting to river front side, therefore development of Inland Water Transport facility exponentially improves services of river transport in the city, presently the city periphery infrastructure road and rail based freight transportation are carried out and these modes of transport are pre-dominated in the nature.

With keeping in mind of IWT sector development may it enhance the transport profile of city freight transportation with waterways routs, the development of IWT terminals along the Ghats of river Ganga at Varanasi envisage to meet increasing freight transport demand of the city.

The prospective development of IWT transport corridor in Varanasi city accelerate economic development of the region.

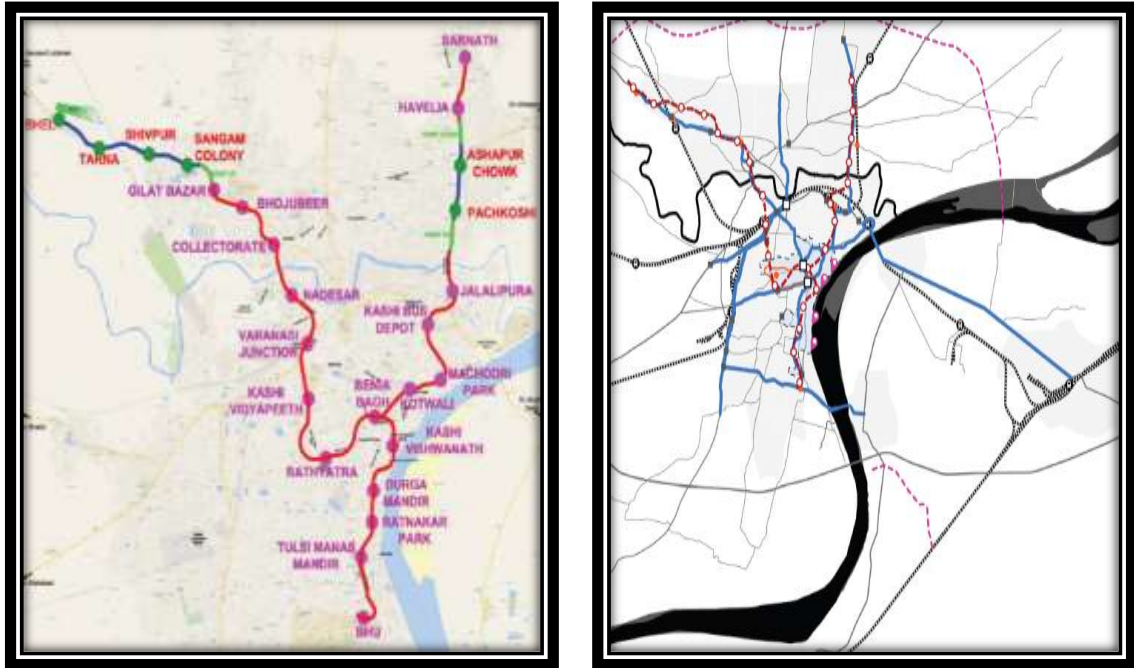
6.5 IWT stimulates development of Urban Ferry/Ro-Ro Transport Network at Varanasi

Riverside is the centre of trade, commerce and tourism, most of the economic institutions were located along the main roads from the river side and used importantly for industrial purposes.

Varanasi city presently not having formal modes of transport much of the urban transportation are depended upon the informal and paratransit modes of transport facility, the present government policy response on development of smart transportation system for the city by including consideration of water transport facility development maximizes the opportunities of intermodality between IWT and existing shared modes of public transport.

Under Smart city plan of development, the city has planned for development of Metro stations and most of the proposed metro stations lies in right of the river stretches

³ Working Paper 175, December 2014, Published by Institute of Studies in Industrial Development

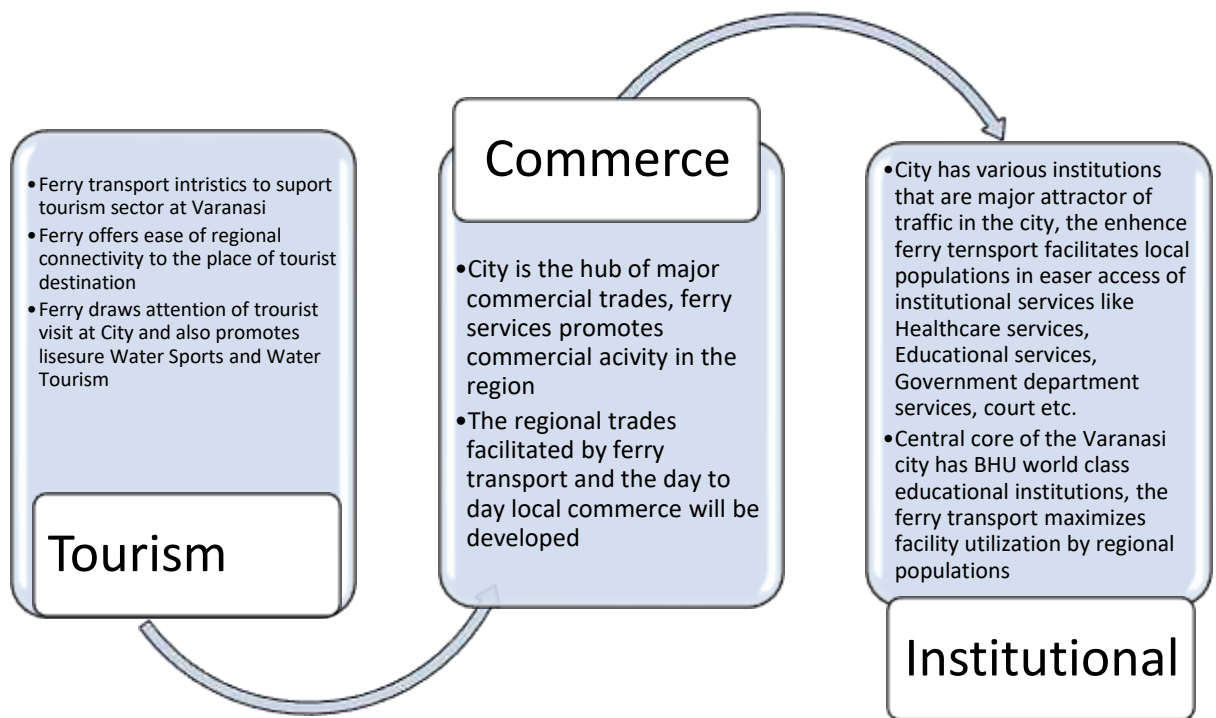


(Fig. No.180 Integration of Metro Routes with Ferry Transport System at Varanasi)

In above figure we can distinguish that most of the ferry lands may developed along the adjacent to the metro facility at Varanasi, are there are much possibility of developing integrated ferry transport system with roadways and Metro at Varanasi, the rise of development of metro needs for speed and safe commuting, and integration of ferry services enhance the development of ridership at Varanasi city.

The transportation demand are continuously increasing in the city and most of the existing infrastructure are already under pressure, therefore handing efficient traffic management in future for the city is challenging hence integrated ferry transport planning are required for Varanasi

The development of consistent and reliable infrastructure improves transportation city in core of the city and provides opportunities of economic growth. The integration of water born infrastructure in local transport planning provide better access of connectivity with regional destinations.



(Fig no.181. Indicative economic benefits of ferry transport at Varanasi city)

Varanasi is situated in the most populous state “Uttar Pradesh” where one sixth of India’s population resides where intermodal city transportation profile characterized as slow moving traffic.

The composition of city traffic consist of cycle, 2-wheelers, autos, tempo etc. for passenger mobility within the city, the city has significant cross regional traffic due presence of business centre, educational hubs, market places and various attractors of religious & tourism centre etc.

Varanasi city is the oldest urban settlements and having spiritual capital of India, the tourist from all over the world visits here for experiencing the cultural & spiritual phenomena along the various Ghats of the Varanasi. ⁴

The Ganga River water considered as scared holy water hence thousands of the peoples comes here to take holy bath and feel essence the spiritualism. The Harishchandra Ghat has presence of active cremation site and Dashashwamedh Ghat has daily worship ceremony filled with prayers, fire and dance etc.

The river front of Ganga is heavily utilised for religious, tourism and cultural purposes etc. and these centres are heavily utilised and the proposed ferry terminal at these key indicative locations having potential traffic for ferry services operations year-around, it also supplements and supports the public use of river water front, improves Ghats restoration, pollution control and strengthening the transport services.

Inland Waterways Authority of India is autonomous body of Govt. of India is working for development and administration of National Waterway-1, the authority has appointed

⁴ Final Report, January 2019, District Development Plan of Varanasi, Prepared by Indian Institute of Management Lucknow

international consultant's M/s TDG+MIT/IAL for development of ferry services along NW-1. The study on development of ferry transport at Varanasi city has identified major nodes where immediately ferry services may be started.

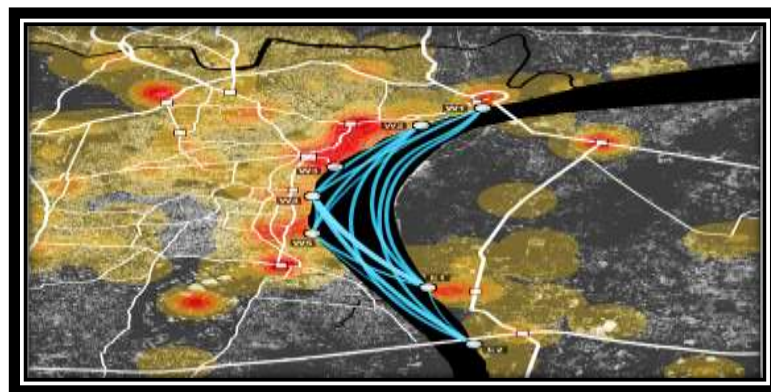
Proposed ferry site	Nearby city node	Proximity Ghats
W1-Kashi	Kashi Inter-modal Terminal	Raj Ghat/Rani Ghat
W2-Ghasi Tola	Maidagin/Machodari Park	Ram Ghaat/Gaay Ghat/Gola Ghat
W3-Kashi Vishwanath	Godowalia Crossing	Munshi Ghat/Dashwamedh Ghat/Tripura Bhairavi Ghat
W4-Ratnakar Park	Sonarpur Crossing, Vijay Chauraha	Harishchandra Ghat/Shivala Ghat
W5-Tulsi Manas Mandir	BHU-Lanka Crossing/ Assi chowk/Durgakund	Tulsi Ghat/Assi Ghat/Sant Ravidas Park
E1-Ramnagar Fort	Ramnagar Chowk	Ramnagar Dock
E2-Ramnagar MMT Varanasi	Tengra Chowk	MMT Varanasi

(Table No.47. Indicative list of potential ferry sites identified by IWAI for development of Ferry Transport at Varanasi city)

The traffic conditions and nature of urban settlements of Varanasi has created the traffic demands for ferry operations, new transport system at Varanasi is not limited to the ferry transportation system it extended the linkage with the other socio-economic values and urban benefits.

The proposed ferry transport system may help to reduce vehicular congestion from the narrow lanes/roads of the city, proposed ferry services will be ideal mass transits transportation solution and impetus towards the model shift for creating greener environment friendly mode of transport in the city.⁵

Ferry transport system caters pedestrian and two – wheeler traffic (bicycles particularly) for using newly viable for mode of transport that help to reduce congestion of city roads. Identifies ferry routes are anchored with important intermodal city nodes, which has strong regional economic surroundings i.e Business centres, Markets places, tourism & religious sites etc.



(Fig. No.182 Route Assignment of Ferry Transport/Ro-Ro Transport at Varanasi City, Source: IWAI, Ministry of Ports, Shipping and Waterways)

⁵ IWAI, Ministry of Ports, Shipping and Waterways

The Development of ferry transportation network along the various Ghats of Varanasi creates opportunities for passenger and goods mobility, newly ferry services links regional mobility to core downtown areas of Varanasi city

6.6 Inland Water Transport Strength, Opportunities, Threats Analysis compared with roadways and railways:

Any shippers take the decisions for transporting their cargo based upon keeping several cost factors such as vehicle related cost, fixed operating cost, trip related cost, quantity related cost and overhead cost.

Cost effective, reliable and efficient modes of transportation requirement can be met by the Inland Water Transport, the development of supply chain with perspective of hub spoke model at MMT Varanasi becomes appropriate destination for delivery and pickup of the cargo

Every shipper aims for minimising their transportation cost, chooses networks of transport to minimize their cost, and achieved assured responsiveness of transportation decisions.

The transportation cost is not only related with the expenditure incurred on shipment of the cargo; however, it involves the cost of holding inventory incurred by the shipper during the transshipment of the cargo.

The facility cost, processing cost, service level cost was also added into the total cost of logistics, therefore the selection of efficient supply chain management is the requirement of the time.

The increasing higher degree of competition in the market, the industry is very keen for selecting the right modes of transport, the existing, modes of transport are already becoming overloaded with several extent, therefore, IWT transport are best suited under such circumstances, the investment in waterways considerably required lesser development investment cost compared with any other modes of transport.

The river front of Ganga is heavily utilised for religious, tourism and cultural purposes etc. and these centres are heavily utilised and the proposed ferry terminal at these key indicative locations having potential traffic for ferry services operations year-around, it also supplements and supports the public use of river water front, improves Ghats restoration, pollution control and strengthening the transport services.

6.7 SWOT Analysis of Inland Water Transport

Strength	Weakness
<ul style="list-style-type: none"> ➤ IWT has higher transportation capacity ➤ Lesser risk of accidents ➤ Reduce city road congestions ➤ Lesser fuel consumption and lesser carbon foot print emission ➤ IWT offers Ferry/Ro-Ro services, therefore cost incurred on bridge construction removed. ➤ Cost effective and environmentally friendly sustainable modes of transport. ➤ Promotes bank to bank connectivity and enhances land and resources utilization along riverside. 	<ul style="list-style-type: none"> ➤ Lower speed of Transport ➤ Limited area of operations ➤ Navigation limited to the day time only ➤ Lack of availability of door to door transportation infrastructure. ➤ Lack of stakeholder's interest ➤ Lack of vessel fleet availability
Opportunities	Threats
<ul style="list-style-type: none"> ➤ IWT has less investment cost in development as compared with any other modes of transport ➤ IWT have opportunities for transportation of heavy cargo without any restriction ➤ Services may become more flexible ➤ Safe mode for transporting hazardous cargo ➤ Lesser requirement of land for development of IWT infrastructure ➤ Utilization of water resources for transportation of cargo. ➤ Generation of employment opportunities 	<ul style="list-style-type: none"> ➤ Operations may interrupted during flood and monsoon season's ➤ Change of river course may lead for navigational problems ➤ Criticism by mass of population and opposition political parties

(Fig. No 183 SWOT Analysis)

6.8 ODC & Cryogenic Cargo Movement Boost Economic Growth of Industries in Varanasi Region.



(Fig.no.184 View of ODC Cargo Movement)

6.9 Contribution of Inland Water Transportation Sector in Atmanirbhar Bharat (Self Reliant India in Logistics Sector) ⁶

Jal Marg Vikas Project has also outlined the vision towards Atmanirbhar Bharat the project benefits support many Industries, MSME and Commercial establishments along NW-1 hinterlands in reducing their total logistics cost by handling cargo through Waterways. Building networks of waterways in India reduces input cost to the industries and increase the efficiency of cargo distributions.

The transportation by waterways is cheaper than road and railways and also causes less damage to the environment. The work of development of Jal Marg Vikas Project being initiated in holistic approach since 2014 onwards after budget announcements by Hon'ble Prime Minister of India, Inland Rivers across the country connects various landlocked states to the sea. The maritime part of the country has emerged as important part of Atmanirbhar Bharat.

The strengthening of Water Transport System also supports in strengthening blue economy stakes in Atmanirbhar Bharat Scheme. India needs more stress on the development of IWT logistics infrastructure as concerned of increased carrying cost of goods from one part to another part of the country in much higher as the developed countries.

The possibilities of reduction of logistics cost are possible with Inland Water Transport, therefore focus has been created for seamless movement of cargo along the land bounded states. The IWT ecosystem makes rapid strides in directional movement of multimodal traffic and increases the connectivity, improves transport and trade efficiency and reduced logistics cost overburden on shippers. The JMVP initiative of developing shipping infrastructure shall also overcome with silos of present mode of transport i.e Roadways and Railways

Varanasi to Haldia approximate 1400 Km of National Waterways is under development, however certain stretches are reaching to the target progress of development. Multimodal Transportation movement with Inland Water Transportation mode offers companies to manage the logistics effectively. The IWT transport solutions increase the portfolio of transportation and storage of goods.

Unlike railways and roadways, the movement of cargo on IWT routes establishes regimen of standards for multimodal transport, the Inland Water Transport operations provide boost to the development of Inland Water Transport Traffic.

The digitization of Ports and National Waterways becomes major enablers of multimodal transportation in India and extensively used to automate the supply chain and documentation of transport.

Multimodal Transport is an evolving solution in India for managing logistics with support of Inland Water Transport, Port led cargo movement is inclined heavily towards west coast due to presence of natural harbours and economic weight of west states. The development of NW-1 under Jal Marg Vikas Project supported for re-routing of marine traffic towards east and networks of NWs will reduce the pressure of cargo traffic from road and railways modes.

Public Private Partnership Investment supports are also encouraged under the Jal Marg Vikas Project where various models of PPP is adopted to encourage private players joins to continue the growth, attract private sector investment in logistics infrastructure development and regulatory measures also eased to develop traffic along National Waterways-1.

⁶ Chapter – 5, National Transport Development Policy committee, NTDPCC Vol-3, Part-2, Ch. 05 Innd 380

The Development of National Waterways – 1 (Ganga-Bhagirathi-Hooghly) river system benefitted four states i.e Uttar Pradesh, Bihar, Jharkhand and West Bengal. The hinterland are mostly touched rural and agrarian society of the country. Inland Water Transport increase the connectivity and boost to the local trade development along its hinterlands.

The maritime potential in economic development was recognised since long decades back, the initiative for development of NW-1 under flagship programme of Jal Marg Vikas Project develops the maritime potential utilization of river Ganga and benefitted local populations of four states.

IWT sector development initiates spark of economic development by construction of Multimodal terminals, Intermodal Terminals, Community jetty, Ro-Ro & Ferry Terminals, construction of indigenous vessels and ship repair facility, advanced policy support, Development of Least Assured Depth for navigation in the river, promotion of IWT vessel traffic management, and offering ground breaking connectivity to the ports.

Jal Marg Vikas Project has stressed the efforts for development of modernised the entire ecosystem of Inland Water Transport Sector ecosystem and develops port infrastructure. The proposed development of Freight Village or Multimodal logistics parks along the MMT Varanasi and Sahibganj gives impetus on development of local and regional economy.

The Vocal for the Local urge insisted and supported by IWT sector by facilitating the small trades within rural folks, and IWT efforts of increasing rural connectivity through Arth Ganga Programme increase the light of economic development of rural economy.

6.10 Jal Marg Vikas Project Overview and role of Inland Waterways Authority of India.

Inland Waterways Authority of India is implementing agency for Jal Marg Vikas Project for augmenting National Waterway - 1 the stretch of about 1380 Kilometres from Haldia to Varanasi with the technical assistance and financial support of the World Bank at an estimated cost of Rs. 5,369.18 crore (Revised project cost Rs. 4633.81 Cr.), The project implementation is planned to be completed by December, 2023, as per the loan agreement signed by DEA with World Bank.

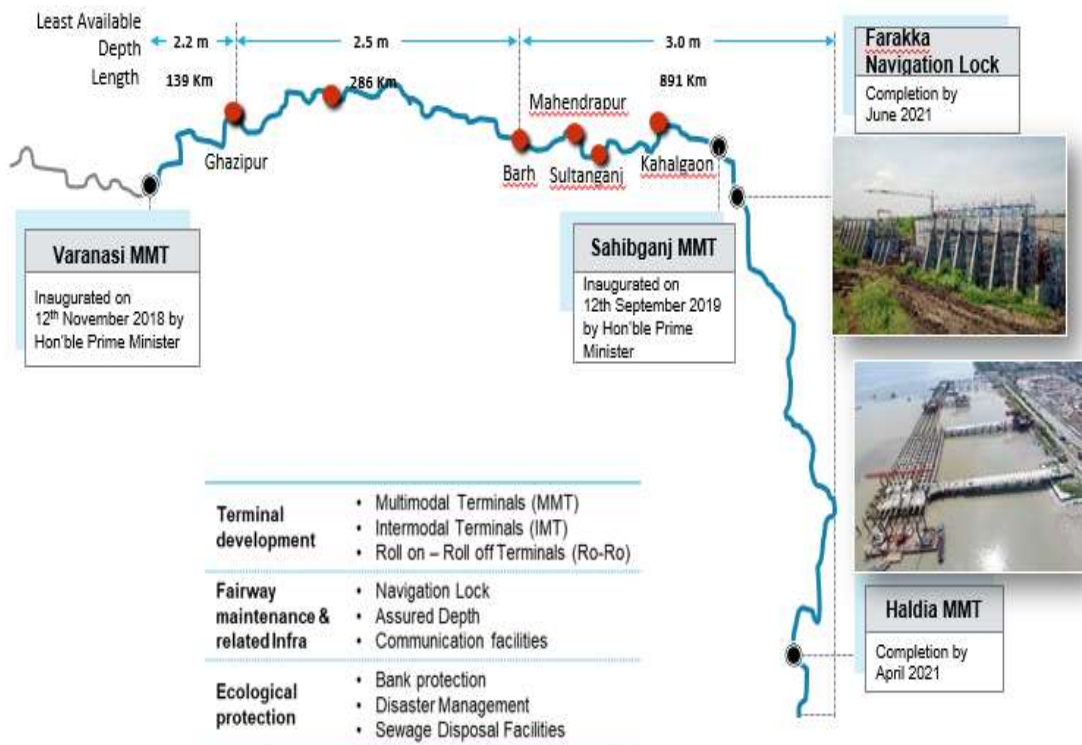
The project aims for development three multimodal terminals i.e Varanasi, Sahibganj and Haldia, one New Navigational lock at Farakka, two Intermodal Terminal at Ghazipur and Kalughat, Five Ro-Ro pairs, Maintenance of least assured depth (LAD), and Development of navigational support infrastructure like DGPS & RIS stations along NW-1 etc.

JMVP is putting integrated efforts for seamless cargo transportation through IWT routes, where by end of December 2023 project objective aims by to improve navigations along NW-1 through fairway development, support movement of larger vessel size 1500-2000 DWT, civil structural constructions, for building logistics model shift and developing communications interventions for disseminating project benefits to end stakeholders through utilization of asset like multi-modal terminals, jetties, Ro-Ro crossings, navigational lock, RIS, night navigation aids etc.⁷

The project is supporting the Government of India ambitious plan to realize the potential of inland waterways as an alternative and sustainable mode of transport, the Jal Marg Vikas

⁷ Working Paper of Texas AM Transportation Institute, WWW. Tti.tamu.edu

Project is being benefitted four resource rich but low-income states (West Bengal, Jharkhand, Bihar and Uttar Pradesh), the natural river system linking seaport gateway at Kolkata (including Kolkata Docks and deep – water dock at Haldia)



(Fig No.185 Overview of Jal Marg Vikas Project along National Waterway-1)

Jal Marg Vikas Project coinciding International benchmarking for providing quality (reliable) IWT infrastructure with integrated multimodal connections, the interventions along NW-1 inducing smart logistics solutions based upon pioneering studies conducted by the international consultants, vessels design of low draft and fuel efficient vessels is already published. For showcasing potential and possibilities of IWT, the 18 pilot movement cases with maximum loaded draft in between 200MT to 2000 MT is completed successfully, the study on disaster management plan is completed and operationalization is being formed

The Jal Marg Vikas Project for capacity augmentation of National Waterways -1 (Ganga-Bhagirathi-Hooghly) river system is implemented by the Inland Waterways Authority of India, Ministry of Shipping with technical and financial assistance of The World Bank with estimated project cost of INR 5369.18 Crores ⁸

The development objective of JMVP project is to enhance transport efficiency and reliability of Inland Waterways for handling logistics. The project comprises of several components and subset activities that aiming to develop Inland shipping, the improvement in ports and marine infrastructure may increase navigability for 1000-1500 Dead Weight Tonnage barges along NW-1 stretch from Haldia-Varanasi (1380 Kilometres) by FY 2023.

National Waterways 1 from Allahabad – Haldia stretch of Ganga-Bhagirathi-Hooghly river system truly considered for national economic importance perspectives, the National

⁸ Ministry of Shipping, Govt. of India, Web link: <http://shipmin.gov.in/>

Waterways-1 corridors of NW-1 passes through densely populated states of Uttar Pradesh, Bihar, Jharkhand and West Bengal, the hinterlands located potential Industries, economic clusters, urban settlements, regional rural villages and towns etc.

Jal Marg Vikas Project is the first major infrastructure project on development of Inland Water Transport sector in India, the various scoping missions of World Bank & several market feasibility studies and detailed engineering studies revealed that operationalization of NW-1 corridors enables transportation of bulk cargo like cement, fly ash, fertilizer, food grains, edible oil, containers, construction materials, project cargo and over dimensional cargo etc. Additionally the regional economic integration may improves due to enhanced connectivity with support of Ro-Ro & Ferry services and the development of cruise vessel operations may also spurt roots for promoting several tourism sites of historical, cultural, religious and pilgrimages etc.⁹

The major engineering interventions are proposed under the Jal Marg Vikas Project are as follows:

- Construction of three multi-modal terminal at Varanasi, Sahibganj and Haldia
- Construction of Inter-modal terminals at Ghazipur and Kalughat
- Construction of New Navigational Lock at Farakka
- Fairway development to provide LAD of 3 meter from Haldia – Barh, 2.5 meter from Barh-Ghazipur and 2.2 meter from Ghazipur-Varanasi etc.
- River training works and re-engineering and bend corrections works
- Strengthening of Navigational Aids such as Channel Marking, Bandalling, Night Navigational Aids, including DGPS, river maps and charts etc.
- Provision for development of River Information System and Vessel Traffic Management System along NW-1
- Construction of five Ro-Ro Pairs
- Construction of Integrated ship repair facility and maintenance complexes etc.

The project has also encouraged several private sector participation under PPP model and the institutional arrangements are aligned for speedy and efficient implementations of plan on ground.

Varanasi Multimodal Terminal:

The multimodal terminal, with a capacity of 1.26 MTPA was inaugurated by the Hon'ble Prime Minister on 12.11.2018. The construction of a 650 mtr long two-lane road connecting the Multi-Modal Terminal with NH-7 and a 35 mtr long and 5.8 mtr wide Truss Bridge) was completed and operationalized on 11.01.19. Rail connectivity from the IWT Terminal to Jeonathpur railway station on the Eastern Dedicated Freight Corridor (EDFC) is planned. The rail alignment is under finalisation in consultation with the Dedicated Freight Corridor Corporation of India and North Central Railway.

Multimodal Terminal at Sahibganj

The multimodal terminal, with a terminal capacity of 3.03 MTPA, is constructed in two phases in Samdanala Village of Sahibganj. Hon'ble Prime Minister inaugurated the terminal on 12.09.2019.

⁹ Ministry of Shipping, Govt. of India, Web link: <http://shipmin.gov.in/>

Rail connectivity is proposed from the terminal to Sakrigali railway station. The rail alignment is under finalization. The operation, management and development of the multimodal terminal at Sahibganj is proposed to be awarded to a private operator under the PPP Model on tender-cum-auction basis. The PPPAC Memo has been referred for appraisal to the Department of Economic Affairs



(Fig.No.186. Container unloading at MMT Sahibganj, along NW-1)

Multimodal Terminal at Haldia

The multimodal terminal at Haldia, with a terminal capacity of 3.07 MTPA, is being constructed in two Phases on a 61 acres land in the Haldia Dock Complex leased from the Kolkata Port Trust (KoPT) on 30 year tenure. The work on Phase-I was awarded to M/s ITD Cementation at a cost of Rs. 517.36 crore on 30.06.2017, The physical progress is 96.85% and financial progress is Rs. 457.48 crores as on Feb 2020. Rail alignment for connectivity from the terminal is under finalisation in consultation with the Haldia Dock Complex.

The proposal for Equip, Operate and Transfer (EOT) at the multimodal terminal at Haldia to be awarded to a private operator under the PPP Model on was appraised and recommended for approval by the Expenditure Finance Committee (SFC), chaired by Secretary, Ministry of Ports, Shipping and Waterways, on 23.04.2020 and bidding under process.



(Fig. No.187. View of under construction MMT Haldia on NW-1)

Navigational Lock at Farakka

The new navigational lock is being constructed on 14.86 ha of land in the Farakka Barrage Project (FBP), taken on transfer from the FBP on 02.03.2016. The construction work of this lock, awarded to M/s Larsen & Toubro Ltd. on 24.11.2016 at a cost of Rs. 359.19 crore has achieved physical progress of 80.37% and financial progress of Rs. 258.89 crore as on Feb 2020

Intermodal terminal at Kalughat

An intermodal terminal is proposed to be constructed on 5.159 ha (12.80 acres) of land in Kalughat, Saran district of Bihar, with road connectivity to NH-19. SIA study of the proposed land is completed. Possession Certificate of 13.17 acres of land received on 26.09.2020. DPR is ready and tender process for award of work is in progress. The Terminal is being planned to handle mostly container traffic destined to Nepal.

Intermodal terminal at Ghazipur

An intermodal terminal is proposed to be constructed on 8.917 ha of land in Ghazipur, Uttar Pradesh. 4.386 ha of land has already been acquired and registered with IWAI. Balance 4.531 ha of land is at an advanced stage of acquisition. DPR is ready. Tender process has been kept on hold due to poor response shown by the prospective bidders in a stakeholder meeting held in Mumbai

Ro-Ro terminals

The locations for five pairs of Ro-Ro terminals have been identified at Rajmahal and Manikchak; Samdaghat and Manihari; Kahalgaon and Tintanga; Hasnapur and Bakhtiyarpur and Buxar and Saraikota. Various studies are in progress. The low cost solution for development of the Ro-Ro terminals which is now under consideration of Aarth Ganga Program of JMVP



(Fig. No.188 View of Ro-RO Vessels Playing on NW-1)

Output /Outcomes under JMVP¹⁰

The following outcomes/outputs have already been achieved under the project:

- a) Vessels of capacity of in between 1000-1500 DWT started navigating along on NW-1, against the vessel capacity of 750 DWT in 2015-16.
- b) Phase-1 of the multimodal terminals at Varanasi and Sahibganj, with modern cargo handling facilities, have been completed and commissioned. Construction work on the new navigational lock at Farakka and the Haldia MMT is at advanced stages.
- c) Aids to Navigation & River Information System were made fully operational.
- d) Traffic volume on NW-1 increased from 5.06 MMT in 2014-15 to 6.79 MMT in 2018-19 to 9.11 MMT in 2019-2020 and till date 7.9 is already achieved in 2020-2021 despite facing impact of COVID -19 circumstances
- e) IWAI has developed an optimal dredging policy for NW-1, which is not only very efficacious considering the hydraulic and morphological characteristics of Ganga, but also substantially cost-effective.
- f) Thirteen new vessel designs suited for navigation on NW-1 have been developed which are already available on public domain for use by prospective vessel manufacturers.
- g) Project has implemented best environmental practices by development of zero waste discharge terminals, several environmental protective initiatives were taken preventing marine and aquatic ecology along NW-1
- h) The vexatious issue as to whether maintenance dredging in rivers require prior environmental clearance under the EIA Notification of 2006 was resolved with the MoEF&CC confirming that this does not require. MoEF&CC also confirmed that inland waterways, terminals, jetties etc. are not covered under EIA Notification, 2006 requiring prior environmental clearance.
- i) The long pending issue of transfer of the existing navigational lock along with the appurtenant land, buildings and structures by the Farakka Barrage Project (FBP) to IWAI and its rehabilitation and modernisation was resolved with the transfer of the same to IWAI in April, 2018.
- j) The overall R&R implementation performance has made remarkable progress since project launch. The critical R&R activity in the project - relocation of houses in Sahibganj is completed for Phase-I works. The remaining sub projects – Kalughat & IMT Ghazipur IMTs – land acquisition is at an advanced stage. The R&R progress is upgraded to Satisfactory as relocation activities almost complete for phase-I works and is reasonably progressing for remaining R&R activities.
- h) The Mid Term Review meeting was conducted during 8th – 21st December 2020 by The World Bank, where Jal Marg Vikas Project overall project development objective is rated Satisfactory by the World Bank Group.

¹⁰ Ministry of Shipping, Govt. of India, Web link: <http://shipmin.gov.in/>

6.11 IWT Transport Encourages Investments from Private Sector through Public Private Participation Mechanism: ¹¹

Jal Marg Vikas Project has encouraged several Private Sector Participation under PPP model and the Institutional arrangements are aligned for speedy and efficient implementations of plan on the ground.

The Global request for proposal for Equip, Operate and Transfer (EOT) for MMT Varanasi is published on 14.05.2020, the current bid due date is 04.01.2021 and it is expected that successful concessionaire may be appointed by March 2021.

The Global request for proposal for Equip, Operate and Transfer (EOT) for MMT Haldia is published on 14.05.2020, the current bid due date is 11.01.2021 and it is expected that successful concessionaire may be appointed by March 2021.

The Global request for qualification for Operation, Management and Development of Multimodal Terminal at Sahibganj, Jharkhand published on 12.11.2020, the bid due date is 22.01.2020 and it is expected that PPP agreement may signed with successful concessionaire for operation management and development for MMT Sahibganj will be signed by August 2021.

At present scenario the business of riverine ports along National Waterways-1 in India are at nascent stage, development efforts under JMVP May influx private sector participation by creating enormous business opportunities and economic benefits. The high level private sector participation are expected in near future.

6.12 Economic Perspective of River Transport (Conceptualization of Arth Ganga Programme under Jal Marg Vikas Project along National Waterway-1)

The Jal Marg Vikas Project has conceptualised “Arth Ganga” to energise the economic activity along the hinterlands of river Ganga. the development of Small community jetty, Ro-Ro, Ro-Pax and ferry services etc. may developed along the banks of river Ganga to boost the economic activity at community level.

The Gangetic belt of National Waterways-1 touches four states i.e Uttar Pradesh, Bihar, Jharkhand and West Bengal. The Arth Ganga programme is also aligned with objective of Jal Marg Vikas Project that aims for bring down the total logistics cost, offers complementary, safe and environmentally sustainable mode of transport.

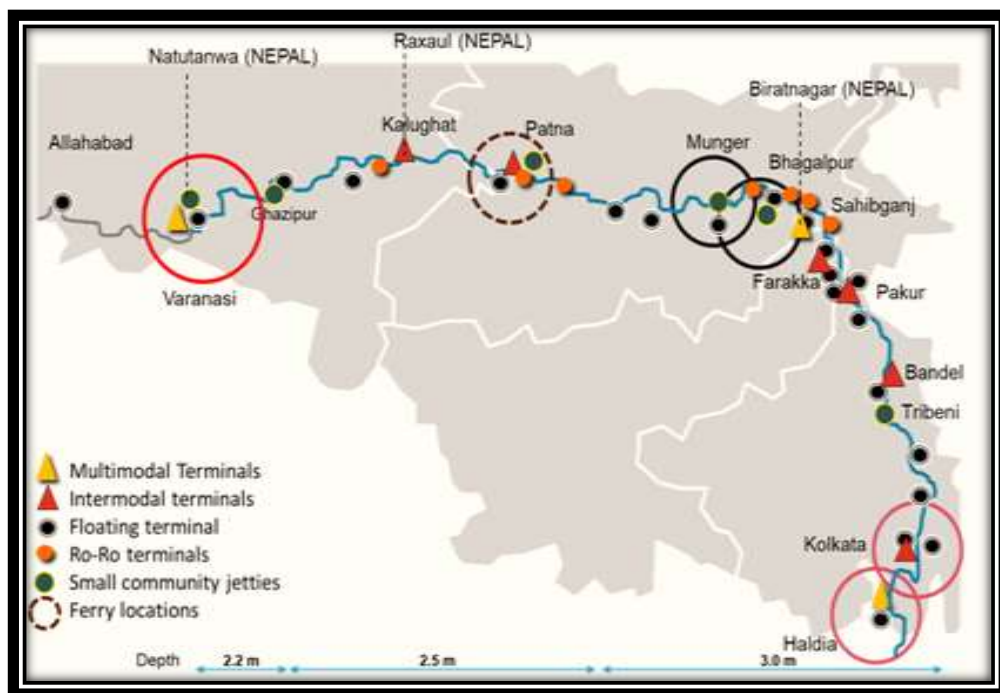
The Arth Ganga Programme objectively planned to provide project benefits to grass root level community that living along hinterlands of NW-1, about 40 floating jetty and 10 Ro-Ro terminals are being planned for development on river Ganga.

The Arth Ganga programme will bring down the logistics cost for farmers in movement of agriculture produce/local cargo, this will help to provide benefits in terms of promoting regional trade and offers access of local markets, this support in economic enhancement and also facilitate in passenger transportation.

¹¹ National Shipping Board, Govt. of India, web link: <http://nsb.nic.in/content/>
Official Portal of Sagarmala, Ministry of Shipping, Govt. of India,
Web link: <http://sagarmala.gov.in/>

The 'Arth Ganga' project encourages large scale skills enhancement and attracts public/private sector Investment in development of Water Transport facility along river Ganga.

Jal Marg Vikas Project is developing critical transport infrastructure that helps in social and economic development of country, the government policies and programmes has realised the potential of water transport sector. Therefore, the capacity augmentation and ports development are needed for handling cargo. The growing requirements of overseas trades the inland shipping industry joins their hand with maritime transport movement. Inland Water Transport sector promotes indigenous bottom trade and attract several externalities investment in development of Inland Water Transport Sector.



(Fig No.189 Master Plan of Arth Ganga Programme along National Waterway-1)

The Government's initiatives emphasis on the needs of people's participation and synchronise development of communities, societies, villages, towns and cities along hinterlands of National Waterway -1 by implementing ARTH GANGA flagship programme under Jal Marg Vilas Project, the project aims for building an ecosystem for economic development along NW-1 river banks by strengthening Inland Water Transport infrastructure.

The Jal Marg Vikas project already under implementation and strengthening utilization of river water resources for transportation purposes, it emerges concept of improving local economy near Ganga-Bhagirathi-Hooghly river corridors.

The Arth Ganga programme is more about of strengthening local economy by providing low cost, reliable, realistic, sustainable and environmentally friendly modes of Inland Water Transportation solutions to the various sections of societies and industries established along National Waterways – 1.

The river has various direct and indirect impacts on local economy, the mighty river like Ganga sets best illustrations for impacting billions of human settlements and lives along its basin. The populations are connected with river at different levels of attachments and also meeting their requirements. However, the Jal Marg Vikas Project and Arth Ganga Programme considering to make river Ganga hinterland as hub of transportation linkages and strengthening multiple economic activity in the region.

The development of Multimodal Terminals at Haldia, Sahibganj and Varanasi supported for movement of large-scale cargo and boost Inland Water transportation sector in India, however for moving local economy along river hinterland, the Arth Ganga programme proposes for developing community jetty across four states Uttar Pradesh, Bihar, Jharkhand and West Bengal.

The project proposes to provide low cost IWT logistics solutions for transporting local goods and allowing local communities in reaching market places directly for selling their local produce by avoiding middleman interference.

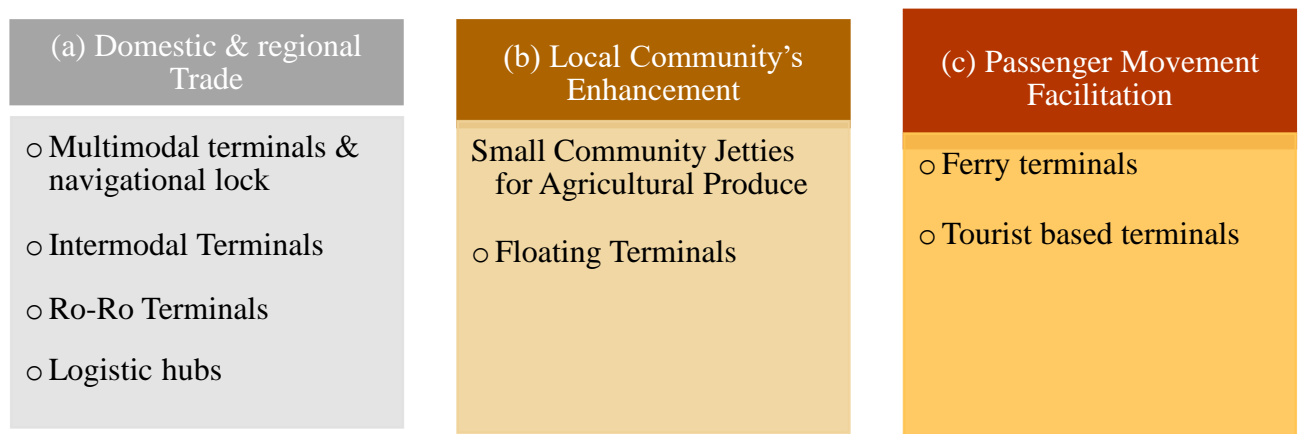
The Arth Ganga programme is developed by government and likely to be driven by local peoples and communities of states for their own economic needs and welfare. At different locations on NW-1 the community jetty will be developed to offers IWT connectivity in rural hinterlands and facilitates transportation of local cargo to the nearby city nodes easily.

Arth Ganga programme offers supports to the government initiative of Self-Reliant Bharat” by facilitating transportation of local produce to the regional markets and give strengthening to the “Vocal for Local” availability in local market places.

The programmes like Arth Ganga requires detailed deliberations, discussions and broader communications disseminations required with communities and stakeholders living along NW-1. The JMVP marketing communications efforts role as facilitator, supporter, and collaborator to aware the citizens and stakeholders regarding economic benefits reaped from river-based transportation in handling local cargo.

Economic Development prospects of Varanasi under Arth Ganga Program¹²

The development under the Artha Ganga scheme in association with Jal Marg Vikas Project (River Ganga) can be envisaged in 3 broad categories:



¹² Open Government Data Platform, Government of India, Web link: <https://data.gov.in/>

(Fig. No. 190. Arth Ganga broader economic benefits at Varanasi Region)

In India, almost half the population lives around the Ganges River belt. However, the region is economically one of the most backward regions in the country and left behind in the development bandwagon.

In terms of trade, about 1/5th of all India's freight originates and 1/3rd terminates in the states around Ganges Belt. However due to city congestion and space constraints, there is hardly any scope for land-based development possible in the region. Hence, in order to accommodate the needs of the people living in this region, River Ganga can play a pivotal role in generating the growth prospects in terms of sustainable economy.

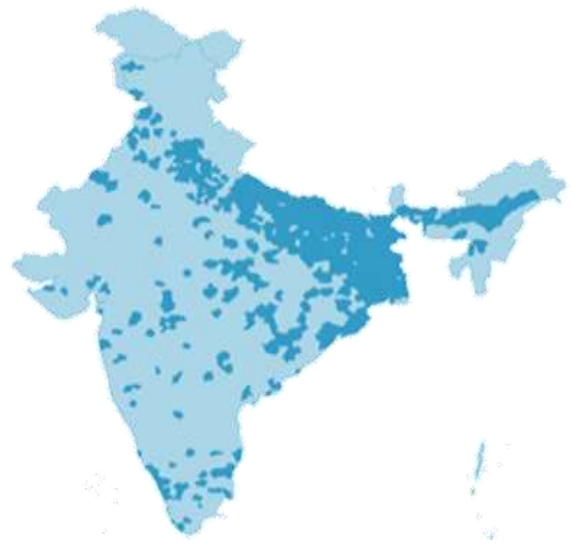


Fig. no. 191. India's population split in half

6.13 IWT Sector facilitates development of domestic & regional trade along Ganga at Varanasi & other regions of National Waterway-1: ¹³

Under JMVP, the multimodal terminals at Varanasi (Uttar Pradesh) and Sahibganj (Jharkhand) are operational whereas the third at Haldia (West Bengal) is under construction. Besides, a new navigational lock at Farakka is being developed with an objective to reduce lock operation timings. Apart from above, 2 inter-modal terminals are being planned at Ghazipur & Kalughat. 4 pair of Ro-Ro terminals are also identified which are proposed to be developed in consultation with the State Governments.

These developments will not only enhance domestic trade but will also act as a main conduit of connection with Nepal, Bangladesh, Bhutan & Myanmar to enable bilateral/ multilateral/ transit cargo movement.

Apart from above, permanent terminal at GR Jetty (Kolkata) has been handed over to M/s SAPL on PPP basis and terminals at Gaighat, Patna is also planned to be given to private player for operations. The terminals at Varanasi, Sahibganj & Haldia would be handed over to private players on long term concessions under PPP.

Two locations viz. Varanasi & Sahibganj have been identified for development of freight villages and logistic hubs. Freight Village will act as cargo enabler and provide optimal modal choice to shippers. They will further augment economic development in the hinterland of the multimodal terminals:

(a) Freight Village & Logistics Hub (FV&LH) at Varanasi: The proposed freight village at Varanasi will help to develop Varanasi as a cargo aggregation and trans-shipment hub to boost the local economy and providing a state of the art warehousing facility. With total addressable market of 16 million tonnes, the Freight Village will be able to capture 3.2

¹³ The Asian Journal of Shipping and Logistics 33(4) (2017) 279-288, Article - The Logistics Performance effect in International trade, Authored by Azmat Gayani, Associate Professor, Sultan Qaboos University

million tonnes of divertible cargo. This volume will be further enhanced due to upcoming industries in the primary hinterland and cargo divertibility through proposed EDFC. Apart from this, FV&LP will also provide an added advantage in terms of creation of jobs in the district (~4,500 direct workplaces, indirect workplaces upto a factor of 2 to 3)

- (b) **Industrial Cluster cum Logistics Park (ICLP) at Sahibganj:** On request of Govt. of Jharkhand in Apr 2017, an ICLP is being planned at Sahibganj. The proposed ICLP is expected to create synergy with Inland Waterways & spur socio - economic growth in the hinterland. The ICLP will not only provide logisitcis faciitiies but will also motivate small and medium scale Industry development in the vicinity including Agri-food processing, mines & minerals, textile, energy, warehousing & logsitics. These industries are expected to generate employment to the tune of 100 – 150 people/ industry.

6.14 Inland Water Transport Facilitates Local community’s enhancement through Arth Ganga Transport Development Initiative: ¹⁴

Besides being a transport modal for large cargo movement, River Ganga will also provide opportunity for small diara farmers to transport their produce through waterways which is cost effective and environment friendly. IWAI’s internal Communications studies have found that products like Marigold from Kaithi in Varanasi, vegetables from Ghazipur and Munger, Banana and Paan from Hazipur and fruits from Bhagalpur are transported in abundance in nearby cities.

Hon’ble Shri Mandaviya has announced that small jetties will be set up along the Ganga to boost the economic activities at the community level. The communities along the banks of Ganga are also availing skill development trainings for enhancing livelihood being facilitated by IWAI in coordination with State Livelihood Missions and other schemes like Pradhan Mantri Kaushal Vikas Yojana, Deen Dayal Grameen Kaushal Vikas Yojana. Apart from above, 19 floating jetties are also provided on River Ganga which may be usitised for local produce movement



(Fig.192. IWT Plan for development of regional trades through enhanced river transport)

¹⁴ Panteia, research report on Contribution to Impact Assessment of measures for reducing emission on Inland Navigation, published by European Commission’s Directorate-General for Transport, Zoetermeer, June 10, 2013

6.15. IWT Sector facilitates Passenger movement at Varanasi and other regions of National Waterway-1

- (a) **Local commute:** A large volume of locals is largely dependent on river transport for their daily commutes from one bank of Ganga to other. ~18 bridges over River Ganga between Allahabad & Haldia are distributed at an average distance of approx. 100 km, which results in long distance travels by roads to reach to opposite bank of the river. Considering this scenario, IWAI is conducting a study on potential ferry locations in 6 major cities on River Ganga viz, Varanasi (Uttar Pradesh), Patna (Bihar), Munger (Bihar), Bhagalpur (Bihar), Kolkata (West Bengal) & Haldia / Sagar (West Bengal). The study is aimed to provide sustainable and cost effective transport for over 25 million citizens. Approx. 18 locations will be finalised for development of ferry terminals. Once the locations are finalised, ferry terminals will be developed and operated on viable business models.
- (b) **Tourism:** Ganga also has huge potential for river tourism considering its ancient history and cultural ties with the hinterland cities. Infact, various cruise operators viz., M/s Heritage River Cruises Pvt. Ltd. and M/s Vivada Inland Waterways have been operating their cruise vessels on River Ganga and IWAI plays the role of a technical facilitator for river cruise tourism. Various cruise circuits on River Ganga having tourism potential are:
- a. Allahabad circuit: Allahabad has a literary and artistic heritage, Kumbh Mela attracts millions from across the globe and Chitrakoot is an important pilgrimage site of Hindus approximately 70 Kms from Allahabad & connected by road.
 - b. Varanasi Circuit: Varanasi is widely considered to be the second oldest city in the world and visited by millions from across the globe.
 - c. Patna circuit: Gaya and Bodhgaya are connected by road with Patna. Nalanda and Rajgir are one on the same road route and 80 kms and 95 kms respectively, from Patna. Vaishali, an important Buddhist tourist place is at a distance of 35 kms from Patna. ‘Chath Puja’ is also a unique attraction along the ghats of Patna.
 - d. Bhagalpur Circuit: Mandir Hill is located about 30 kms from Bhagalpur and well known for its mythological background. Sutlanganj is an important religious center for the Hindus, situated on the bed of river Ganges at a distance of 26 km from Bhagalpur. It is also the starting point for the annual pilgrimage to Shiva Temple at Deoghar during ‘Sawan’
 - e. Kolkata Circuit: This circuit has important religious places related to all religions (Ganga Sagar, Belur Math, Dakshineswar Temple, Pareshnath Jain Temple, Kalighat Temple, Nakhoda Mosque, St. Paul’s Cathedral, St. Andrews Church, Old NizamatImambara, Katra Masjid) and all the palaces are within 20 kms from the river banks.

6.16 IWT Sector other associated economics benefits along National Waterway-1 & Varanasi region:

Apart from providing benefits in terms of trade, local community’s enhancement and passenger facilitation, the Artha Ganga project will also ensure large scale skills enhancement and public/ private sector capability developments.

- (a) **Skill development & Employment Generation :** The development, operations & maintenace of various sub-projects, services proposed/ ongoing under Arth Ganga would result in large number of persons skilled in various tradeswhich are directly/ indirected

related to IWT sector. IWAI, is already providing various training programmes through its training centre i.e. National Inland Navigation Institute (NINI) established at Patna. The institute provides induction, up gradation and professional development training to the manpower for manning, operating inland vessels and to the IWAI. The institute also provide professional development courses on hydrographic surveying, dredging, repair, maintenance & operations of Inland vessels as well as on river training and morphing.

However, to cater to the direct and indirect skills requirement which may arise due to the proposed Artha Ganga scheme and are currently not being taken care by NINI, specialised training may be planned in consultation with State Government & other maritime universities.

Types of Employment Generated	Various Types of Expert/Manpower/Professionals services are required in future for water transportation sector
Development and Maintenance of Fairways	<ul style="list-style-type: none"> - Marine Engineer - Civil Engineer - Hydrographic Surveyors - Hydro dynamic expert - Dredging expert - Marine Engineers - Navigation Experts - River Engineering - Civil Engineering - Mechanical & Marine Engineering - Naval Architects - Logistics Expert - Economist - Market Expert - IT Professional
Personals required for Development and Management of the Multimodal terminal facilities, cargo services, freight village	<ul style="list-style-type: none"> - Marketing and Business Development Professional - Terminal Manager - Traffic Manager - Marketing & Logistics Manager - Administrative Manager - Finance Manager - Storage and Warehouse Expert - Economist for IWT - Logistics & Warehouse Supervisor - Marketing Support Staff - Administration and Finance Support Staff - Engineering Professionals - Marine Professionals

<p>Personals required for Management, Operation, Maintenance and Repair for Inland Fleet</p>	<ul style="list-style-type: none"> - Crew (Floating Staff) for O & M - Supervisory Staff (required for supply of Logistics, scheduling, deployment, utilization and arranging & attending to major & Statutory repair works (Annual & Dry Docking) for producing statutory certificate - Manpower for design and construction of Inland Fleet and carrying out repair work at repair yards - HR Professionals - Technicians - Administrative Staff
<p>Personals required for Design and Construction of economical & efficient fleet/Classification of Surveyors</p>	<ul style="list-style-type: none"> - Manpower required for design, construction and repair of Inland fleet at Shipbuilding facility and Ship Repair Facility - Competent Surveyors are required to comply the rules and regulations for statutory duties entrusted for survey, inspection to register the new vessel, issuance and renewal of annual survey certificates after examine their Inland Waterways
<p>Personals required for Cargo Promotion, Marketing and Policy Formulation</p>	<ul style="list-style-type: none"> - Marketing Research Professional - Logistics Expert - Traffic Expert - Marine Expert - Business Development Expert - Legal Expert - Communication & Promotion Expert - Economist

(Table no. 48)

Varanasi is situated in the agro climatic zone of eastern plain region of Uttar Pradesh, bordering the districts of Jaunpur in the North, Ghazipur in the North East, Chandauli in the east, Mirzapur in the South and Sant Ravidasnagar in the West. The total area of the district is 1535 sq. km, supporting of population of 31.48 lakh persons

The details of major manufacturing clusters in the district and generated employment are as follows

S No	Manufacturing cluster	No. of functional units in the cluster	Turnover of the cluster (INR Cr)	Value of exports (INR Cr)	Employment generated
1	Silk weaving	2,000	10	3	6,000
2	Silk brocade	2,000	12	9	7,000
3	Glass bead	8,000	102	75	20,000
4	Handloom				
i	Cholapur	380	0.48	0.085	760
ii	Saraiayan	350	0.99	0.05	350
iii	Bazardeeha	350	0.99	0.05	350
iv	Baragaon	350	0.99	0.05	350
v	Harshosh	350	0.99	0.05	350
vi	Jallalipura	350	0.99	0.05	350
vii	Lallapura	350	0.99	0.05	350
viii	Saraimolna	350	0.99	0.05	350
ix	Katehar	350	1	0.08	350
5	Stone carving	800	3.75	1	1,800

(Table No. 49)

(Table no. 42.. No. List of Major MSME Manufacturing Clusters Generating Export and Employment at Varanasi region, Source: Report on bried industrial profile of Varanasi district, prepared by MSME department, Govt. of India)

(b) MSME & Major Industries in Varanasi and Hinterland that benefited by IWT Sector:

1. M/s Bharat Heavy Electrical Ltd.
2. M/s Diesel Locomotive Works
3. M/s Hindustan Liver Ltd.
4. M/s Bharat Coco-cola Beverages Pvt. Ltd.
5. M/s Shree Agro Oils Pvt. Ltd.
6. M/s JVL Agro Industries Ltd.

(c) Development of Public and Private sector capabilities: The new developments under Artha Ganga will ensure large number of public and private sector participation in the niche IWT sector in various areas including development, operations, maintenance and management. To encourage investments and participation of private sector, following steps have already been initiated by IWAI on River Ganga:

- a. SOM contract to SAPL for O&M of GR Jetty and BISHN jetty, Kolkata
- b. Equip, Operation and Transfer (EOT) of Varanasi & Haldia MMT to be awarded to private operator by O&M concessions for Varanasi MMT and Haldia MMT
- c. Operation, Management and Development Agreement (OMDA) concession for Sahibganj MMT

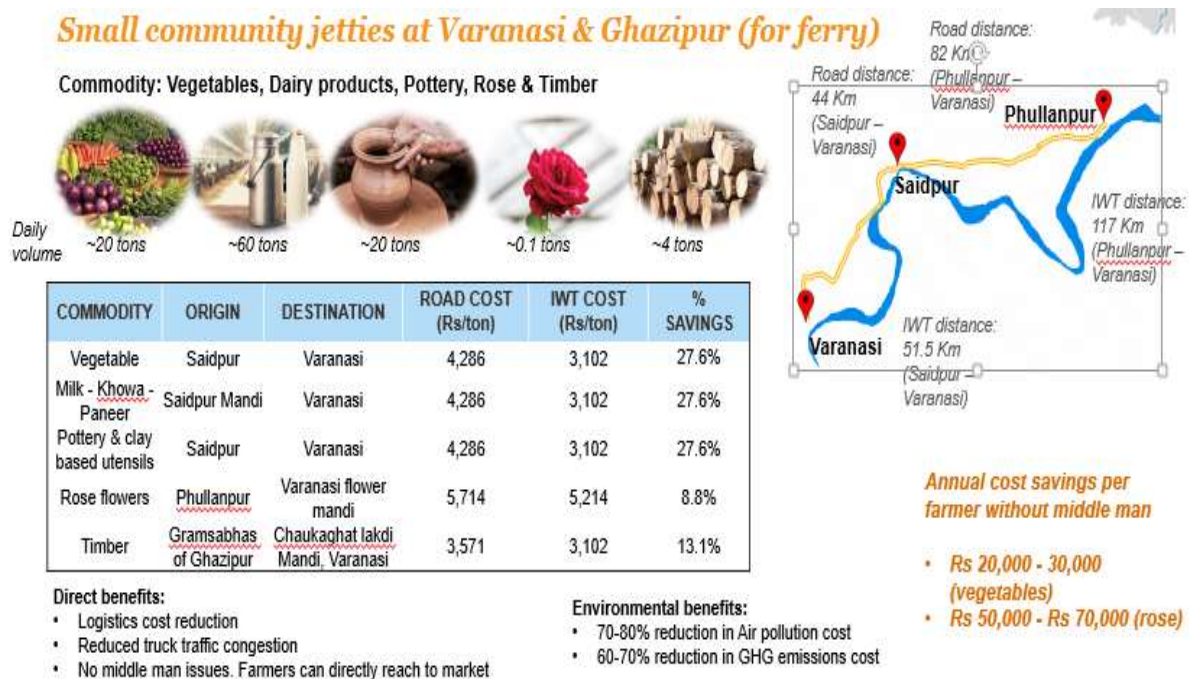
(c) Development of small community jetty for movement of local agro products through river routes:

The Jal Marg Vikas Project and upcoming Arth Ganga program both made efforts to establish Water Transport for most reliable mode for transportation of cargo along the National Waterway-1

The Arth Ganga program supports initiative of developing small community jetty, passenger jetty to facilitates the development of rivarine transport along the NW-1 hinterlands.

- Present modes of transport having following challenges at Varanasi city
- Truck congestion in the city
- Higher Logistics cost
- Middle man takes the maximum margin, leaving nothing for the producers
- Long distance routes due to limited bridges on River Ganga
- Load restrictions on most of the Bridges in Patna region
- Air Pollution & GHG emissions

The development of water transport connectivity along the rural hinterlads initiates overall regional economic development of the region:



Small community jetties at Varanasi (for Ferry)

Commodity: Marigold



Daily volume: ~0.7 tons (1 mini truck)

ORIGIN	DESTINATION	ROAD COST (Rs/ton)	IWT COST (Rs/ton)	% SAVINGS
Kaithi	Kisan phool Mandi Varanasi	2857	2838	1%

Direct benefits:

- Logistics cost reduction
- Reduced truck traffic congestion in highly congested city of Varanasi
- No middle man issues. Farmers can directly reach to market

Environmental benefits:

- 60% reduction in Air pollution cost
- 55% reduction in GHG emissions cost



Annual cost savings per farmer without middle man

Rs 70,000 – 100,000

(Fig No.193. Plan of regional freight diversion along NW-1 at Varanasi region, Source: IWAI)

Exiting IWT Asset Utilization Matrix & Economic Benefits along National Waterway-1 Hinterlands (Table. No. 50)

Chainage	RCC Terminal / lock	Floating terminal	Ro-Ro terminals	Industries	Tourist points	Advantage to farmers
101-200	MMT at Haldia	Haldia		Edible oils, fly ash, coal, containerised cargo		Edible oil plantation
201-300	GR Jetty - II	Botanical Garden, GR Jetty/ BISN, Tribeni		Jute crafts & vegetables	Kolkata (Barrackpore, Chandernagore, Serampore, Dakshineswar Temple & Victoria Memorial)	Jute & vegetable farming
301-400		Shantipur, Swaroopganj		Fly Ash, textile, food grains, coal.	Mayapur ISCON temple	
401-500		Katwa				
501-600		Hazardwari			Hazarduari Palace, Imambara, Khushbagh	
601-700	Navigational lock	D/s Farakka & U/s Farakka, Rajmahal	Rahmahal-Manikchak	Stone chips, silica, sand, coal		
701-800	MMT Sahibganj	Sahibganj, Bateshwarsthan	Samdaghat-Manihari, Sahibganj - Karagola	Stone chips, coal, fly Ash	Vikramshila Vishwavidyalay, Bateshwarsthan temple	Fruits, vegetables & Grains farming
801-900		Semaria		Fly Ash, paper, food grains, food processing. Carpet, stone chips	Semaria (Nalanda, Bodh Gaya)	Vegetable farming

Chainage	RCC Terminal / lock	Floating terminal	Ro-Ro terminals	Industries	Tourist points	Advantage to farmers
901-1000			Bakhtiyarpur-Mehnar, Mokama			
1001-1100	Patna jetty, IMT Kalughat (proposed)		Hajipur - Patna	Banana & Pan, Nepal going cargo, container cargo, fly Ash, stone chips	Patna (Harmandir Sahab, Golghar, Gandhi Museum)	Banana & paan plantation
1101-1200	IMT Ghazipur (proposed)	Buxar, Ghazipur	Buxar-Saraikota	Dairy & Vegetables	Ghazipur (Tomb of Lord Cornwallis) Buxar (War memorial)	Vegetable farming
1201-1300	Kaithi, Varanasi	Varanasi, Khirkiya Ghat		Marigold, Cement	Markanday Temple	Marigold Plantation
1301-1400	MMT Varanasi	Rajghat, Varanasi		Cement, locomotive & heavy machinery manufacture.	Varanasi (Vishwanath Temple, Sarnath, Ganga Aarti, Ramnagar fort)	
1401-1500					Chunar (Chunar fort, Vindhyachal temple)	
1501-1620		Allahabad			Triveni Sanagam, Allahabad fort, Anand Bhawan, Lakhshyagrah	

6.17 Development of IWT Sector, Logistics Park and Special Economic Zones at Varanasi region:

15

Keeping in view the strategic location of Varanasi as a focal point in the logistics chain of Eastern Transport Corridor of India, as NW-1; Eastern Dedicated Freight Corridor (EDFC); and NH-7 and NH-2 pass through/near Varanasi, a multimodal terminal with road connectivity from the IWT terminal to NH-7 and rail connectivity from the terminal to Jeonathpur railway station on the EDFC is under development.

Varanasi is strategically located and is a focal point in the logistics chain of Eastern Transport Corridor of India, as the NW-1; Eastern Dedicated Freight Corridor (EDFC); and NH-7 and NH-2 pass through/near Varanasi. The current traffic volume in the region is negligible. The IWT Sector Development and Business Development Study commissioned for the Jal Marg Vikas Project (JMVP) projected a phenomenal increase in the traffic volume in the Varanasi region when the JMVP and the EDFC are commissioned.

In India, the share of IWT in the total cargo traffic as per 2014-2015 is only 0.4%, while the share of railways is 30% and that of roadways is 61%. Government of India had given priority to development of infrastructure for the railways and roadways over decades, while the IWT sector was neglected, as a result, the shippers are currently in a better comfortable zone with the railway and roadways modes of transport.

A mammoth marketing and cargo aggregation strategy is needed to put in place to attract the shippers to make a modal shift to the IWT mode of transport, Unlike in the case of railways, the current legal and administrative set up for the IWAI does not permit it to enter into commercial activities. Further, IWAI lacks the expertise and trained manpower to operate and maintain the multimodal terminals.

The solution, therefore, lies in harnessing the potential in the private sector in this area. A private operator will have the operational flexibility to create systems suiting the market needs to attract shippers; he would be better suited to source the required expertise to operate and maintain the terminal efficiently; he is better placed in terms of market access, vessel leasing/procurement and cargo mobilization for optimal utilization of the terminal facilities compared to IWAI

6.17.1 IWT based Freight Village Development at Varanasi:

The Freight Village is proposed to be set up near the multimodal terminal at Varanasi with the objective of creating a logistics hub, wherein the logistics' companies and water related manufacturing & trading companies are brought under one roof by allotting land on lease so that a productive logistics neighbourhood is established and ease of doing business is enhanced. The Freight Village will also provide support to stimulate development of a professional logistics industry in Varanasi.

Presently, there is no logistics centre at the IWT terminal at Varanasi. After the multimodal terminal is commissioned, vessels with the capacity of up to 2000 DWT would be able to berth at the IWT terminal and will have the infrastructure facilities required to handle the expected increase in the volume of cargo traffic from JMVP and EDFC through synchro-modality. The logistics' companies and water related manufacturing & trading companies in the proposed Freight Village near the multimodal terminal will establish a productive logistics neighbourhood and enhance ease of doing business.

¹⁵ United Nations Economic Commission report on Diesel Engine Exhaust Myths and Realities

NW-1, together with the proposed Eastern Dedicated Freight Corridor (EDFC) and a number of National Highways (NH-1, NH-2, NH-80 etc.) constitute the Eastern Transport Corridor of India, connecting the National Capital Region with Kolkata, the seaport gateway of India to the Bay of Bengal

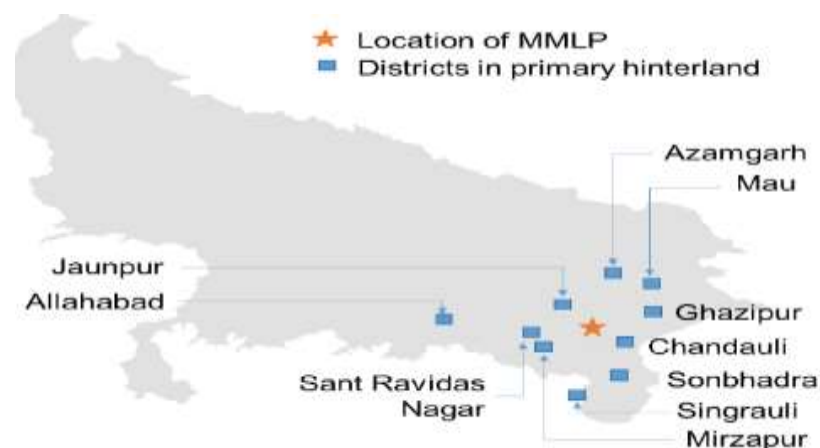
It is estimated that the annual freight flow through this corridor is about 370 million tons. The total freight flow generated from or destined to the six States in the corridor is about 40% of the overall flow of cargo in India. In spite of a significant difference in geographical distance, the States of Bihar and Uttar Pradesh prefer the western sea ports of JNPT and Kandla over the Kolkata Port, while the port usage for Jharkhand is equal between the western ports and Kolkata.

This is largely due to the limited choice of transport mode, poor hinterland connectivity and to some extent, sub-optimal port infrastructure and efficiency in Kolkata Port. On the other hand, West Bengal and the hinterland have the potential to become the gateway for trade with the East because of its close proximity to Orissa and Chhattisgarh (one of the major mineral belts of India), access to North East Region and link to Bangladesh, Myanmar, Thailand, Nepal and other east and south-east Asian countries. ¹⁶

In order to incentivise movement of substantial portion of cargo from the western ports to the Kolkata port and to the rapidly growing Paradip and Dhamra ports in Odisha and to open up vast opportunities in inland as well as ex-India movement of cargo through this transport corridor, NW-1 is being developed with the necessary infrastructure and assured depth in the navigational channel through the Jal Marg Vikas project, which will function in tandem with the proposed EDFC and a number of National Highways. Varanasi has a locational advantage, as it has a vast agrarian hinterland with proximity to NH-7/NH-2 and EDFC. The multimodal terminal at Varanasi, with connectivity to NH-7 and to the EDFC through the Jeonathpur railway station, is expected to serve as a focal point in the logistics chain of Eastern Transport Corridor of India with complementarity amongst Inland Waterway, road and rail modes of transport. The estimated cargo flow through the Varanasi MMT is: 3.55 MMT by 2020; 3.82 MMT by 2025; 10.12 MMT by 2035; and 10.32 MMT by 2045.

The proposed Freight Village at Varanasi will attract logistics' companies and water related manufacturing & trading companies to Varanasi and establish a productive logistics neighbourhood and enhance ease of doing business as in the case of Specialized Economic Zones. The Freight Village will also provide support to stimulate development of a professional logistics industry in Varanasi

¹⁶ India Maritime plus brochure published by Ministry of Shipping, Govt. of India

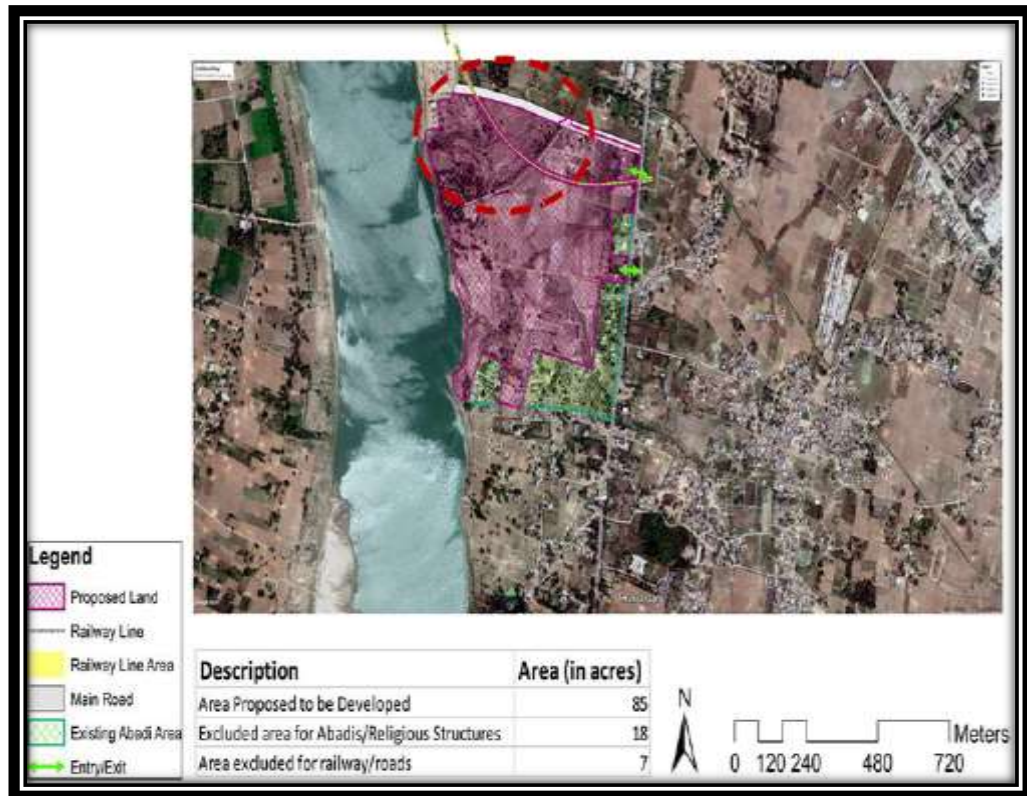


(Fig. No.194. Primary hinterland economically benefitted by development of freight Village at Varanasi)

16.17.2 Economic Benefits of developing Freight Village along riverine port, Varanasi: ¹⁷

- i. Augment economic development in the hinterland of the multimodal terminal at Varanasi by promoting employment generation and SME sector growth
- ii. Reduce logistics cost in the eastern transport corridor and its influence zone
- iii. Promote the use of waterway transport on river Ganga (NW-1) between Haldia and Varanasi and of rail transport on Eastern Dedicated Freight Corridor (EDFC) in the North bound direction which facilitates movement of freight from road to water and rail
- iv. Develop Varanasi as a cargo aggregation and trans-shipment hub to boost the local economy and providing a state of the art warehousing facility
- v. It has been observed that the upcoming freight village at Varanasi shall induce a spur in local economy by potentially generating 3600 direct and indirect additional job opportunities. The employment opportunities are envisaged in works like administration, safety & security, cargo handling etc. It shall also promote growth of local SMEs in the hinterland due to Varanasi being developed as a transshipment hub.

¹⁷ Assam Government Report on IWT advantage Assam, published by the Industries and commerce department of Assam secretariat, Dispur, Guwahati – 6



(Fig No. 195 Indicative Map of Freight Village at Varanasi, located near to the IWT Terminal, Source: Regional Office: IWAI Varanasi, Ministry of Ports, Shipping and Waterways)

Development of Freight Village is proposed to improve the logistics efficiency of the country, enabling reduction in logistics costs. It is proposed to develop freight village in Varanasi adjoining newly developed multi modal terminal at Varanasi

6.18 Major Economic gears of developing Freight Village along with IWT Ports Development at Varanasi: ¹⁸

i. Freight aggregation and distribution

Freight Village act as hubs for freight movement enabling freight aggregation and distribution. Freight from production zones will be shipped to nearby logistics parks, where it will be aggregated and shipped to a logistics park near the consumption zone on a larger sized vehicle. Freight arriving at the destination logistics park will be disaggregated and distributed to the consumption zones.

ii. Multimodal freight transportation

Freight Village with road land, Inland water connectivity and rail connectivity enable multimodal freight transportation. This aids freight transportation on long haul (between hubs) to shift from road to rail and waterways (wherever possible), thereby reducing the freight cost

¹⁸ CUTS International reports on Expanding Tradable Benefits of Inland Waterways Case of India, published on December 2017 with support of The Asa Foundation and printed by MS Printer, Jaipur

iii. Storage and warehousing

Freight Village provide modern mechanized warehousing space, satisfying the special requirements of different commodity groups. With higher proportion of mechanized material handling, warehousing in freight village will reduce storing and handling losses.

iv. Value added services

Freight Village also provide value added services such as packaging and labelling, inventory management, quality checking, customs clearance with bonded storage yards, kitting, sequencing, tracking, tracing etc. Further set of services include management of inbound and outbound activities on behalf of the tenant just-in-time and just-in-sequence delivery to local customers, direct delivery to international customers from the facility and reverse logistics.



(Fig. No 196: IWT Survey Vessel Navigating near Raj Ghat Bridge at Varanasi)



(Fig. No. 197. Construction of Varanasi MMT on going by M/s AFCONS Ltd)

6.19 IWT Sector Building Economically and Environmentally Sustainable Logistics Network in India.¹⁹

National Waterway-1 (Ganga – Bhagirathi-Hooghly) river system need to be managed in the integrated manner to ensure smooth navigation of IWT Vessels by meeting the synchronised goals of river conservancies, navigation and flood management activities.

The preparedness and interventions of Jal Marg Vikas Project along NW-1 aims to focus for the development of river-environment friendly and economically viable mode of transport. The insights of development for NW-1 creates various transportation linkages along the navigational routes of Ganga – Bhagirathi – Hooghly river system, the proposed navigable routes pass through four states i.e Uttar Pradesh, Bihar, Jharkhand and West Bengal covering the total distance of 1620 Km.

The movement of cargo vessel (DWT 1500-2000) along the river basin uptakes countless physical interventions, the identified approach and continuing efforts like bank protection works, bandalling, dredging, river training and conservancy works etc. that improves river flows and depth.

The sustainable efforts for the development of Inland Water Transport reviews various morphological behaviour of river Ganga, the real time continuous digital monitoring of river analyse water level, discharge, bathymetry and sediment transportation etc.

The Inland Water Transport helps to integrate multiple stakeholders, the study on IWT development reveals about enormous economic potential of developing Ganga River for transportation purposes.

The dredged materials may be used for the construction of embankment and creates platforms to save coastal villages from the impact of uneven floods. The huge siltation in the river may increase the height of river bed, the maintenance dredging activity in the river channel may help to monitor, improves navigability and reduce pre-monsoon floods.

Inland Water Transport is low cost, environmentally viable and ecologically sustainable transportation mode, the expenditures incurred on land acquisition, rehabilitation and resettlement being minimal in case of developing waterways.

The river management plan is well integrated promoting inter sectoral development of National Waterways -1, every terminal on river Ganga is having proper waste management plan, the sewage generations and treatment will put more stress on protection of riverine ecology.

Inland Water Transport harnessing the potential of water resources for transportation purposes, the integrated efforts of developing navigation on river Ganga benefits the environment by reducing lesser fuel consumption for meeting future targeted logistics demand of the country.

River Ganga has so many intangible economic values and the ecosystem services of river focussed for better management of natural resources in nation's development, the government of India makes huge budgeted expenditure on the river Ganga for mitigating flood control, biodiversity protection, irrigation, fisheries, tourism and transport etc.

The environmental protection by holistic river resource management approach, develops detailed framework of monitoring Inland water flows, depth of river management, Bank protection and flood controls etc.

¹⁹ National Transport Development Policy Committee report on INDIA TRANSPORT REPORT MOVING INDIA 2032 published by Routledge in 2014

Inland Water Transport putting parallel efforts with NMCG in restoration of ecological balance in the river and also developing the water transport infrastructure in the country.

The projects of Inland Water Transport have developed realization among various stakeholders in the country for commercial and economic potential of the river waters. The multimodal transportation project has stressed for detailed provision for environmental impact assessment (EIA) and use of digital monitoring system revitalized the Ganga basin management.

River conservation Measures on NW-1:

Wildlife clearance for Kashi turtle wildlife sanctuary from NBWL: Wildlife clearance for the movement of vessels through Kashi Turtle Wildlife Sanctuary, Varanasi: The National Board for Wildlife (NBWL), MoEF&CC recommended for movement and plying of Inland Vessels through the Turtle Wildlife Sanctuary, district Varanasi, Uttar Pradesh vide letter dated 12th June 2017 of UP State Board for Wildlife.²⁰

Hilsa Fish Pass at New Navigational Lock at Farakka: The existing Navigational Lock at Farakka which is being used for upstream and downstream movement of vessels on NW-1, has been delegated for migration of Hilsa and will serve as a fish pass. The navigational lock will be operated regularly during monsoon months for upstream migration of the species to rejuvenate hilsa fishery in the upstream of Ganga river. A special arrangement to bypass the Hilsa fish has been made with the consultation with **ICAR – Central Inland fisheries Research Institute, Indian Council of Agricultural Research**. The purpose of this special arrangement on Navigational Lock is to facilitate the movement of Hilsa fish from feeder canal to the upstream of barrage and vice-versa.

Barge Operations & Mitigation Measures has been planned during vessel operation at Eco-sensitive zone sites along NW-1, the special study was undertaken in association with IIT Delhi to study on effect of navigation activities on Gangetic Dolphins and other aquatic animals.

Following mitigation/safeguards measures for safe navigational activities has been planned along NW-1

- Vessel speed would be restricted to 2.7 knots in Vikramshila Gangetic Dolphin Sanctuary areas to reduce noise generation from propeller of the vessel, restricting speed of the vessel in sanctuary area can maintain noise level lower than the tolerance level of dolphins, thus minimising impact of noise on dolphins.
- Vessel should be fitted with propeller guard and dolphin deflectors to minimise dolphin accidents
- Usages of non –toxic and non-TBT containing anti – fouling paints for painting vessels.
- Barge/Vessel movement would be restricted to the designated route only minimize disturbance of aquatic life.
- If any aquatic/mammal/dolphin is spotted then the measures will be taken to push it away through sirens/signals
- All waste from the vessels should be discharged at the terminal/vessel repair facility only.

Bank Protection Works:

Bank erosion is common natural process in rivers, it become accelerated exacerbated by direct and indirect human impact. The bank destabilization affects directly impacts livestock, removal of riparian vegetation and indirectly impacts on channel incision & widening of hydrological alteration in watershed. Bank degradation causes loss of property located along the river, rise

²⁰ The Varanasi Heritage Dossier/History and Development – Wikiversity, dated 1/5/2020

of sediments in the river damages aquatic habitat, widening of river flatten the river bed depth of river decreases that potentially affect the aquatic habitat of the river.

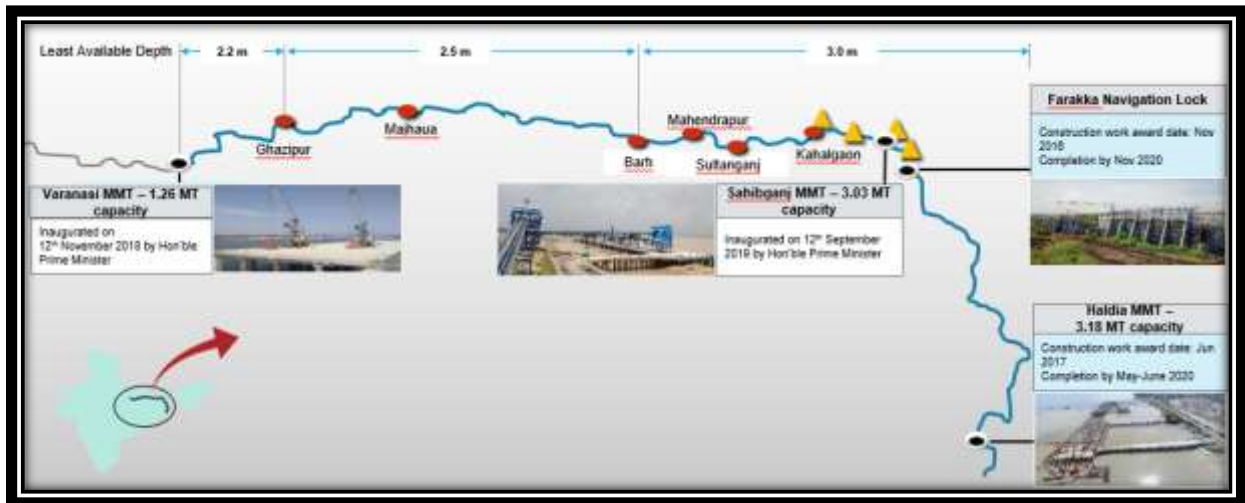
Jal Marg Vikas Project on NW-1 has taken initiative of Bank Protection that helps in maintaining hydro morphological conditions of river and restore maintaining the appropriate depth in the river and restore the Gangetic vegetation.

Bank Protection works safeguard the bank from erosion, the vessel traffic also navigates smoothly along the NW-1, the mitigation measures of bank erosion help in reducing the siltation loads in the river. Protection of embankment of river reduces the flood damages, provides stable vegetation's, reduced soil erosions and provides better environmental outcomes.

Environmental conservation measures already implemented in IWAI:²¹

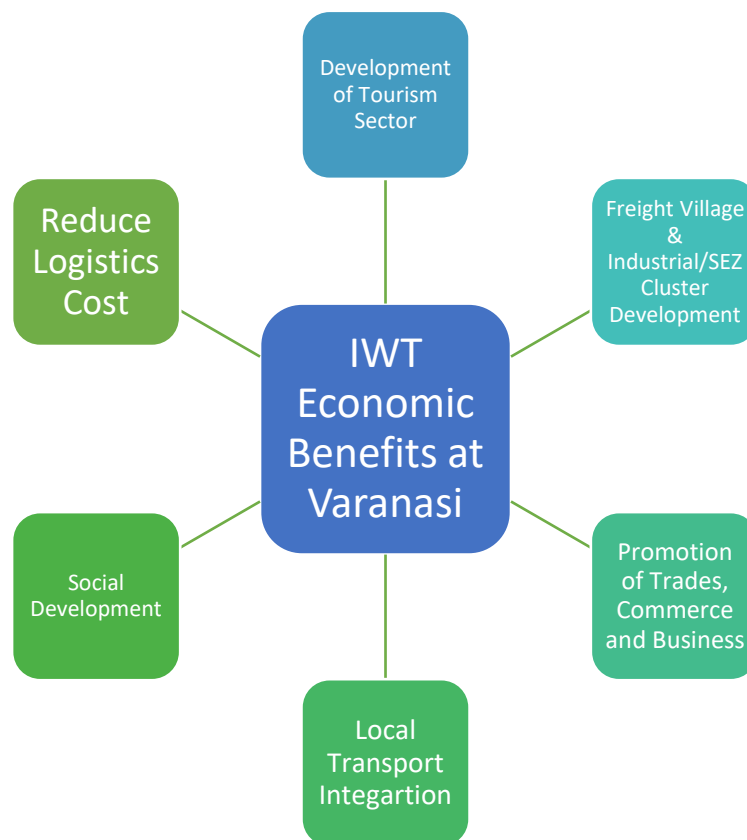
- Terminal sites with minimum possible environmental implications such as loss of trees, noise & dust pollution due to construction
- Greenbelt Development at terminal sites
- Zero waste discharge at terminals and riverside facilities.
- Mandatory propeller guards & engine mufflers on Vessels to reduce noise, dampen vibrations & limit any impact on aquatic life.
 - Dolphin deflector device installed on dredgers to avoid contact of aquatic animal with dredger operation.
 - Used engine oil, metal scrap, bilge water is stored on dredger in separate space without contaminating the river water.
 - Oil Spill contingency plan has been prepared for dredging activity in order to get ready for any accidental spill.
 - Spill kit is present on dredger to counter any emergency oil spill situation.
 - Bio-toilets have been installed at the dredgers in order to avoid river discharge.

²¹ Working paper, Energy Technology, ETSAP Energy technology Systems Analysis Programme, www.etsap.org, dated 15th June 2011



(Fig. No.198. Holistic Plan of IWT Sector development along NW-1, where Varanasi is one of major key node on O-D pairs development)

6.20 IWT Sector Major Economic Benefits:



(Fig. No.199. IWT Economic Benefits at Varanasi)

6.21 IWT Multimodal Terminal at Varanasi Develops Transportation Intermodalism: 22

The transportation industry demand are always context with exploring cost benefits by combining several modes of transport, therefore, invent of transport intermodals takes place, the origin and growth of intermodal transport in India takes place with rise of container transportation with Indian railways.

The development of Inland water transport sector at Varanasi become advent to Inter-modalism transport, as per the European Commission Reports 2000” the intermodal transports constitutes with the process of following conditions:

- (i) Integration of two or different modes of transport (truck, rail, barge, ship or plain)
- (ii) The goods remain in one and the same transport load unit for the entire journey

The intermodality in some sources may refers to the multimodality and multimodal transport known as “Carriage of goods by two or more modes of transport.” Therefore, Intermodal Transport is a subset of multimodal transport.

The multimodal transport and intermodal transport involves multiple carriers in a single shipment, the fundamental of intermodalism is involvement of multiple carriers in single journey.

Container transportation are legible example to be quoted at Intermodals or multimodalism transport. The facility of IWT ports at Varanasi promotes shippers to choose any modes of transport to ship their goods from one place to another, and any private individual can select the operator of their choice in competitive cost for transfer of their cargo.

The different services providers are selected by the cargo owners for transporting their freight from one location to another depending upon the services provided by the carrier and performance evaluated by the customers

The customer has matrix to choose variety of transport modes based upon, cost of transport, speed of delivery, reliability, damage/pilferages, proximity of service to end customer etc.

Cargo may be transported over short and long distances by selecting a variety of modes of transportation. However, the combination of these transport modes, the four main modes of transport used for physical goods transfer offers and the unique combination of economic attributes are valued by the customers during selecting right modes of transport facility for their supply chain management:

²² National Inland Waterways in India, Strategic Report, Shripad Dharmadhikary JindaSandbhor, Published by Manthan Adhyayan Kendra and SRUTI 30 March 2017

Economic attributes valued by stakeholders while selecting different modes of transport for their freight shipment:

	Roadways	Railways	Waterways	Airways
Speed of Transport	Low	Medium	Low	High
Cost of Transport	Medium	Low	Low	High
Reliability of Transport	Medium	Medium	Medium	High
Damage/Theft	High	Medium	Low	Low
Availability of Transport	High	Medium	Low	Low
Storage/Waterhouse Facility	Low	Medium	High	Low
Demurrage Charges	Medium	High	Low	High
Insurance Cost	Low	Medium	Low	High
End to End Transport Services	High	Low	Medium	Low
Police/Traffic Issues	High	Low	Low	Low
Accidents/Miss-hapes	High	Medium	Low	Medium
Operating Cost	High	Medium	Low	High
Repair & Maintenance Cost	High	Medium	Low	High
Suitable of Longer Distance Transportation	Low	High	High	High
Suitable of Shorter Distance Transportation	High	Medium	Medium	Low

(Table No. 51. Economic attributes valued by stakeholders while selecting different modes of transport for their freight shipment)

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Questionnaire for Survey

1. Questions to be asked from Cargo Owner, freight forwarders and Transporter:

a) Please introduce yourself as

Cargo Owner		Freight Forwarder		Transporter	
-------------	--	-------------------	--	-------------	--

b) Are you will you be willing to shift the movement of the inbound/ outbound cargo of your through the Inland Water Transport from Varanasi?

Yes		No	
-----	--	----	--

c) What were the significant factor you see for using Inland Water Transport

Cost		Availability		Reliability	
------	--	--------------	--	-------------	--

d) What is the typical cost incurred during transporting your cargo

Origin	Destination	Commodity Name	Tonnage	Share Railways (%)	Share Roadways (%)	Share Waterways (%)

e) According to you, what economic attribute you valued for selecting any mode of transport (viz. Road, Rail, Waterways & Airways) for freight movement (Please rate 1 for Railways, 2 for Waterways, 3 for Roadways and 4 for Airways)

Transport Attributes	Please Provide Your Ratings
Speed of Transport	
Cost of Transport	
Reliability of Transport	
Damage/Theft	
Availability of Transport	
Storage/Waterhouse Facility	
Demurrage Charges	
Insurance Cost	
End to End Transport Services	
Police/Traffic Issues	
Accidents/Miss-haps	
Operating Cost	
Repair & Maintenance Cost	
Suitable of Longer Distance Transportation	
Suitable of Shorter Distance Transportation	

2. Questions for Truckers O-D survey at NH 7 (Road Side Truck Survey)

Sl. No.	Questions	Response
a)	From where you are coming (Origin Point)	
b)	What commodity you are transporting (Cargo details)	
c)	Where you destinate this commodity (Destination Point)	
d)	How much load qty you are transporting (Tonnage)	
e)	What is the freight cost of transportation per metric tons. (Freight Per Metric Ton)	

Truck Count Survey along National Higway-7

Morning Survey				
Time	5:00 AM to 6:00 AM	09:00 AM to 10 AM	12:00 PM to 1:00 PM	3:00 PM to 4:00 PM
Route				
Towards Allahabad				
Towards Mughalsarai				

Evening Survey				
Time	6:00 PM to 7:00 PM	9:00PM to 10:00 PM	12:00 AM to 1:00 AM	3:00 AM to 4:00 AM
Route				
Towards Allahabad				
Towards Mughalsarai				

3. Survey format for assessment of city traffic congestion at major city node at Varanasi, traffic counting to record primary traffic data of every 15 minutes durations during peak hours (Morning, Afternoon & Evening) at Varanasi.

Major City Node	Timings	Pedestrian	Cycle	Cycle Rickshaw	Two-Wheeler	Auto Rickshaw	Tempo	Car	Other 4-Wheelers
BHU-Lanka Crossing									
Godowalia Market									
Shivala Market									
Padao Crossing									

Ramnanagr Chauraha									
Tengra Mode									
Shashtri Chowk									
Varanasi Junction									
Mughal Sarai									
Kashi Station									
Sonarpura									
Telibagh									
Rajatalab									

4. Questions for Stakeholders Perception Survey along Ganga Ghat for development of Inland Water Transport at Varanasi

a) Stakeholders detailed survey

Sex	Age Group	Education Level	Income range	Occupation	Category
Male	(1-20)	Matric & Bellow	0-5000		Gen
	(20-40)	Intermediate	5000-10000		OBC
Female	(40-60)	Graduate	10000-15000		ST
	(60-80)	Post Graduate	15000-20000		SC
			20000 above		EWS

Sl. No.	Questions	Responses	
		Yes	No
a)	Do you aware about development of water transport in your city		
b)	Dose the development of Inland Water Transport at Varanasi will Reduce the congestion of your city traffic		
c)	Can IWT will makes your local transport more efficient for travel		
d)	The development of water transport improve bank to bank transport		
e)	Do you think IWT will reduce travel time & cost		

f)	Dose IWT transport may benefit fisheries sector		
g)	Dose inland water transport promote tourism sector		
h)	Do you think IWT transport improve local access and connectivity in the region		
i)	Dose water transport provides new employment opportunities		
j)	Do you agree that Water Transport has potential for creating better recreational services		
k)	Are you agree that water transport will improve your livelihood earning sources		
l)	Are you agree that development of water transport will improve trade and commerce of the Varanasi region		
m)	Do you agree water transport will support environment.		
n)	Do you think water transport is safest mode of transport for daily commuting		
o)	Dose water transport of your city will be cost effective mode of transport for daily commuting		
p)	Are you agree that development of Inland Water Transport require capital investment		

b) General Random Survey to access need and reason of local population for crossing river.

For catering what type of need you choose for crossing river Ganga at Varanasi (Please Tick)

Family Visit	Medical Facility	Worship & Religious	Market Access	Educational purposes	Social purposes	Govt, office & Court etc.

c) Survey only with community (Fisherman/Boatman) living along river Ganga at Varanasi

How long you are living along the Bank of River Ganga and what economic activity carried out.

Living Since	Fishing & carrying human remains/dead bodies	Boat riding & fishing	Ferrying Tourist & Passenger	Carrying Cargo & other activities
5 years				
10 Years				
15 years				
20 Years				

5. Interview/FGD Questions:

- a) What are the current logistics issues and bottlenecks you faced by your company in transporting (In terms of rail and road connectivity, availability of truck terminals, warehousing, customs etc.) or any other bottleneck.
- b) What is your opinion about development of water transport at Varanasi
- c) Discussion with prospective IWT stakeholders for cargo, origin & destination pairs, present transport models used, cost and time related data, their proximity for using water transport services at Varanasi.

Tourist Survey Questionnaire

- a) According to your choice which place/sites of Varanasi liked by you

Sarnath		Ganga Ghat		Ganga Aarti	
Sankat Mochan		Durga Kund		Kashi Vishwanath Temple	
Tulsi Manas Mandir		Ramnagar Fort		BHU	

- b) Are you willing to take boat/ferry ride at Varanasi and what will be preferred timings.

Yes		No	Morning	Afternoon	Evening



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For attending National Conference on Importance of Inter-deciplinary

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She/he also presented a paper entitled

**Economic Perspective of Inland Water
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Ramesh
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on 10th May 2019

Quix

Resource Person

Naveen Rajlani

Naveen Rajlani
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He/She presented the paper (Oral/Poster) entitled Role of Water Transportation in Blue Economy and/or exhibited the stall

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Organization: Inland Waterways Authority of India
Event: CILT India Expo 2018
Dates: 22 – 23 November 2018

This is to confirm that **Prakritik Mishra** from **Inland Waterways Authority of India** participated in **CILT India Exhibition and Conference** which was held on **November 22-23, 2018** at **National Rail Museum, Chanakyapuri, New Delhi**.

The 3 day Exhibition and Conference was **organised by The Chartered Institute of Logistics and Transport** in association with **Exhibitions India Group**.

Sincerely

Nidhi Verma

Senior Manager

Co-Organiser

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Certificate of Participation

Mr. Prakritik Mishra is hereby awarded the certificate in recognition of successful participation and presentation of paper on **Social Security for Unorganised IWT Sector Workers** during online National Conference organised by the V. V. Giri National Labour Institute during September 23-25, 2020.

श्री प्रकृतिक मिश्रा

(Dr. Manoj Jatav)
Course Director

No. 2121/53/2020-21
Date: 25.09.2020

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Economic Integration by Inland Water Transport Network at Varanasi

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Mr. Prakritik Mishra, Ph.D. Scholar, Institute of Arts, P.K University, Madhya Pradesh

Dr. Chandrakant Awathi, Professor, Institute of Arts, P.K University, Madhya Pradesh

Abstracts:

The IWT Sector Investment are having multiplier effects of its investments linkages with return, it enhances virtuous cycle of all-round development and growth. The Water Transport Network development in Varanasi hinterland evolve city for centre of large commercial shipping and make transportation system more efficient in that region. The development of Inland Water Transport network is taken fast pace over decade in India, National Waterway-1 (Ganga-Bhagirathi-Hooghly) river system has are having huge economic potential, the availability of water transport facility connect coastal and rural hinterlands areas to offers trade and commerce development in the region. IWT sector creates opportunities of employment generation in region, riverine transport facility may integrates water resources with main stream of economic activity. Alternatively rise of IWT transport facility along Ganga economic corridor expected to realise potential of cargo transportation, passenger transportation and flourishes development of tourism sectors etc.

1. Introduction:

Varanasi region of the Uttar Pradesh is known internationally for its own cultural, heritage properties, and its traditional values, therefore the city has centred for economic integrations along river corridor, The National Waterway -1 passes through this region where Multimodal Terminal is constructed at Ramnagar at Varanasi, the city has many overlapping many economic benefits with floating waters of river Ganges. The Ganga Ghats are itself making large attractions of populations and making many cultural gatherings along river front zones. The Indian Government has taken huge economic investment steps for development of National Waterways-1 and also started developing strategic asset along NW-1 to develop cluster of economic zones along water transport facility.

River Ganga hinterlands touches many economic streams along its corridors, however at Varanasi region also, it integrates with connecting rural , sub-urban and urban city core part, therefore the development of water transport facility in region integrating numerous economic exchanges. The major significance of river Ganga at Varanasi is known for religious and tourism purposes, but depicting and portraying city development as centre of major hub of maritime development.

In rural development and the role of transportation mobility offers sustainable development, the successful operations of development of profitable IWT transport establishes frameworks of business for the future. IWT corridors passes through the rural areas where lack of availability of road and rail networks, therefore development of integrated transport facility atmosphere with IWT supports passenger and cargo movements along river corridor. Optimized operations of vessel in the river with lower draft options supports to carryout multiple economic developments at mouth of rivers.

2. Research Framework

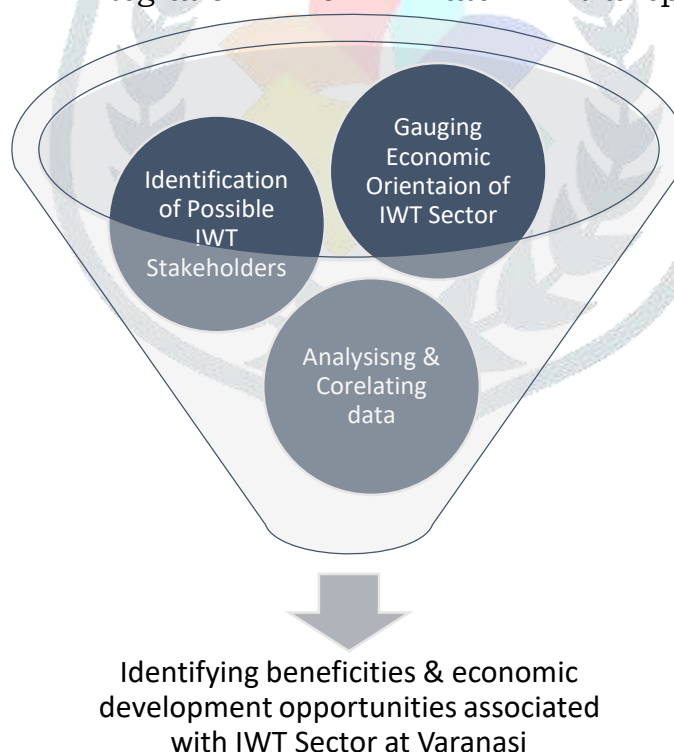
Inland Water Transport has connected vast numbers of stakeholders, therefore, research needed to include imperative participation of stakeholders for while developing research design and approaches to access the economic potential that reap out by development of Inland Water Transport facility along river Ganga at Varanasi region.

The extensive and purposefully participation of stakeholders in research facilitates to identify possibilities of economic development where finds out drivers attached with development of Inland Water transport facility.

The needs and demand of each attached stakeholders are accessed by adopting innovative practical solutions that can be easily replicated with IWT, The gathered information from each segment of stakeholders are unique set used to prepare prepositions for study for Inland Water Transport

The research findings are fundamentally depend upon responses received from each segment of participants, purposefully included in research. A scientific and systematic approach were adopted in study where stakeholders are identified at different locations, special activity performing clusters and homogeneity of the populations. The scope of each group of stakeholders are penetrated, identified and mapped.

The available exiting sources were also gauged based upon their present economic activity, possibilities of association with IWT sector and combination of return are possible with integration of water transport modes etc.



3. Stakeholders Identification & Gauging Economic Orientation

Gangetic plans at Varanasi regions have several groups that may possibility to be associated with Inland Water Transport, this cluster are associated with many stakeholders. The region is very popular for spiritual activity, tourism and possibilities of emerging IWT for trades and commerce purposes.

The eastern Uttar Pradesh Varanasi district are economic corridors for the region, therefore preposition of development of IWT based logistics in product value chain traces equally significance important in transport attributes.

At Varanasi river Ganga used highly by the local communities for multiple use, for economic integration point of view family visits at Ghats for recreation and spiritual purposes, ferry boats were played highly to transport the passenger, boatman and Nishad community are living along the bank of river Ganga, where their economic gains and livelihoods are highly depended upon the river transport, they operates boats and offers services to the passenger for crossing the river.

Fisherman community along the Ganga basin catches fish from the fresh water of the river, where integrated fish market and development of water transport facility helps fisherman in realization of better profit margin of their fish produced, hence IWT sector development directly supported in riverine fisheries development.

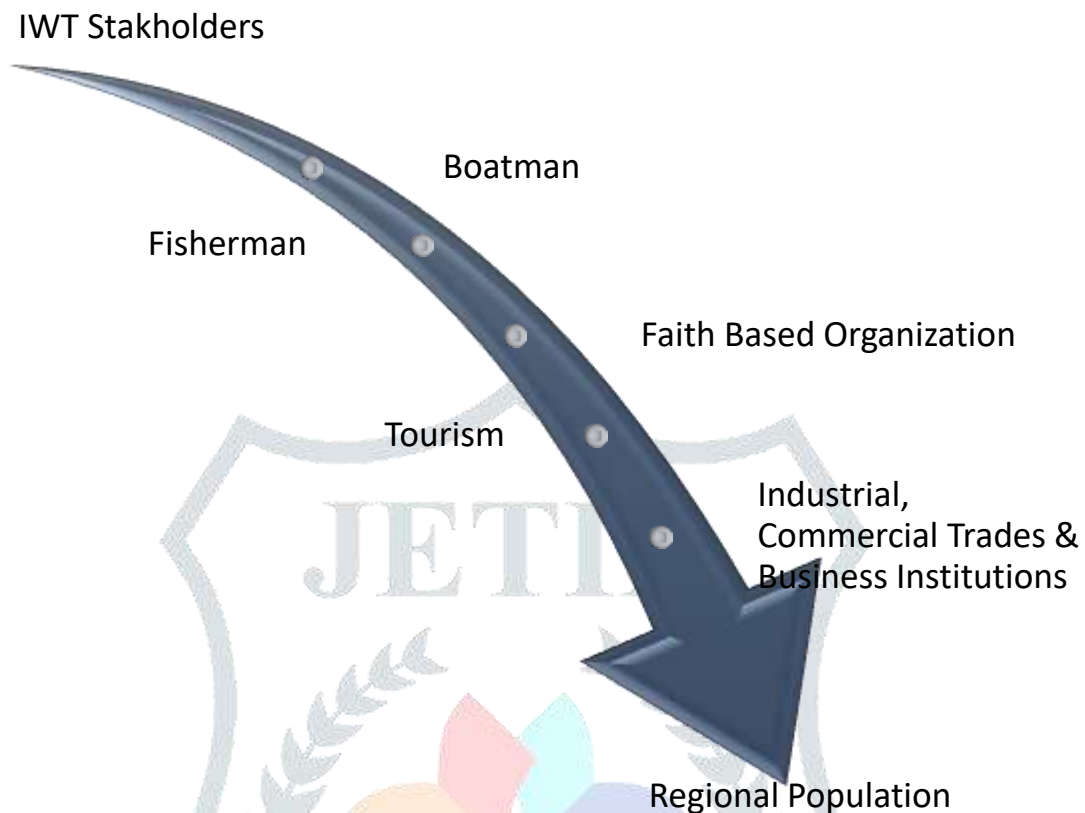
The broader categories of stakeholders are industries and business entities available in the region where they are looking for alternative opportunities for transportation of their cargo, as region exiting road and rail network are already congested, the understanding about degree of importance depend upon the interventions of project stakeholders with exiting socio-political economy of the region.

Religious community and societies of belief institutions are also being stakeholders utilising river Ganges and their interest are also clubbed to the rise of Inland Water Transport modes.

Varanasi has significance for development of logistics network and emerge as hub of economic zone where multiple manufacturing establishments are established, production of vegetable oils, plastic products, textile, carpet industry, value added manufacturing clusters are also be established there, the city is also located on focal plane of Dedicated Freight corridor of the project of Indian Railways and NH-2 Delhi Kolkata a part of Golden Quadrilateral road is also passing through the Varanasi region, hence for economic integration point of view, the Varanasi region are most important.

Development of Freight Village in Varanasi region are becoming game changer for the logistics handling, where large number of warehouse and storage shed facility developed and that were integrated with whole supply chain of the business unit that facilities overall development of the region.

Stakeholders Mapped for utilization of Inland Water Transport facility developed in the Varanasi region:



The primary survey were conducted at Varanasi with identified stakeholder of Inland Water Transport, where, most possible questions has been asked, the stakeholders responses recorded for understanding reasons of using Inland Water Transport for crossing the river.

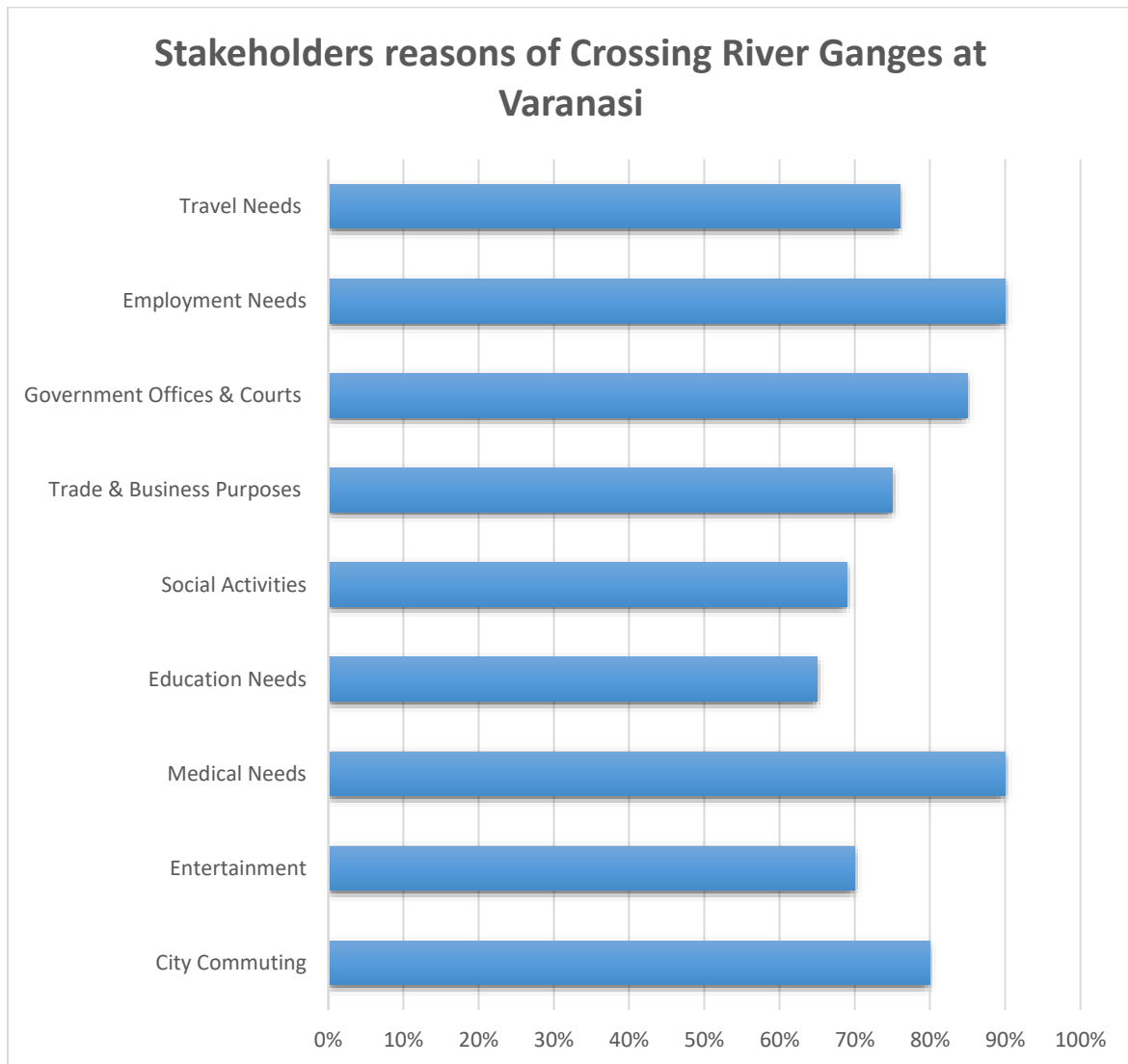
The Major identification was Inland Water Transport has played critical role in the economic integration of the available resources at two different banks at Varanasi region.

The populations living along the different sides of the bank has most possibilities of getting connected with each other, peoples were crossing the rivers by using ferry services or country bots for meeting their various economic needs.

Daily millions of populations are commuting to the city for earning their livelihoods, doing trades, commerce and business, getting education needs, getting services of medical facilities, works in the government offices, courts, market and worships etc.

Therefore it is clearly understood that public are using rivers for many purposes and inland Water Transport may provide opportunities of economic integrations.

Identification of stakeholders reasons for crossing river Ganges at Varanasi



The development of Water Transport facility at Varanasi region has possibly impacted the life of millions of regional stakeholders, the improved water craft services directly reflecting the positive reposes of the stakeholders.

The IWT stakeholders were positively skewed towards the benefits and opportunities associated with Inland Water Transport Facility, the integrated IWT transport with other modes of transport likely to generate employment opportunities, positively impact the life of boatman and fisherman community and also benefits common public, support regional transport development and facilitates development business opportunities.

4. Inland Water Transport Transacts exchange of resources:

The interventions of IWT sector at Varanasi, focussing to scale up the economic development in the region, the water transport facility not only supported the urban commuting solutions but it also facilities for the exchange of resources utilization in the region, the Varanasi city worldwide known for the pilgrimage and spiritual places, the region if called the centre of knowledge in many aspects. Availability of Kashi Hindu Vishwavidalaya (BHU) is significance of it.

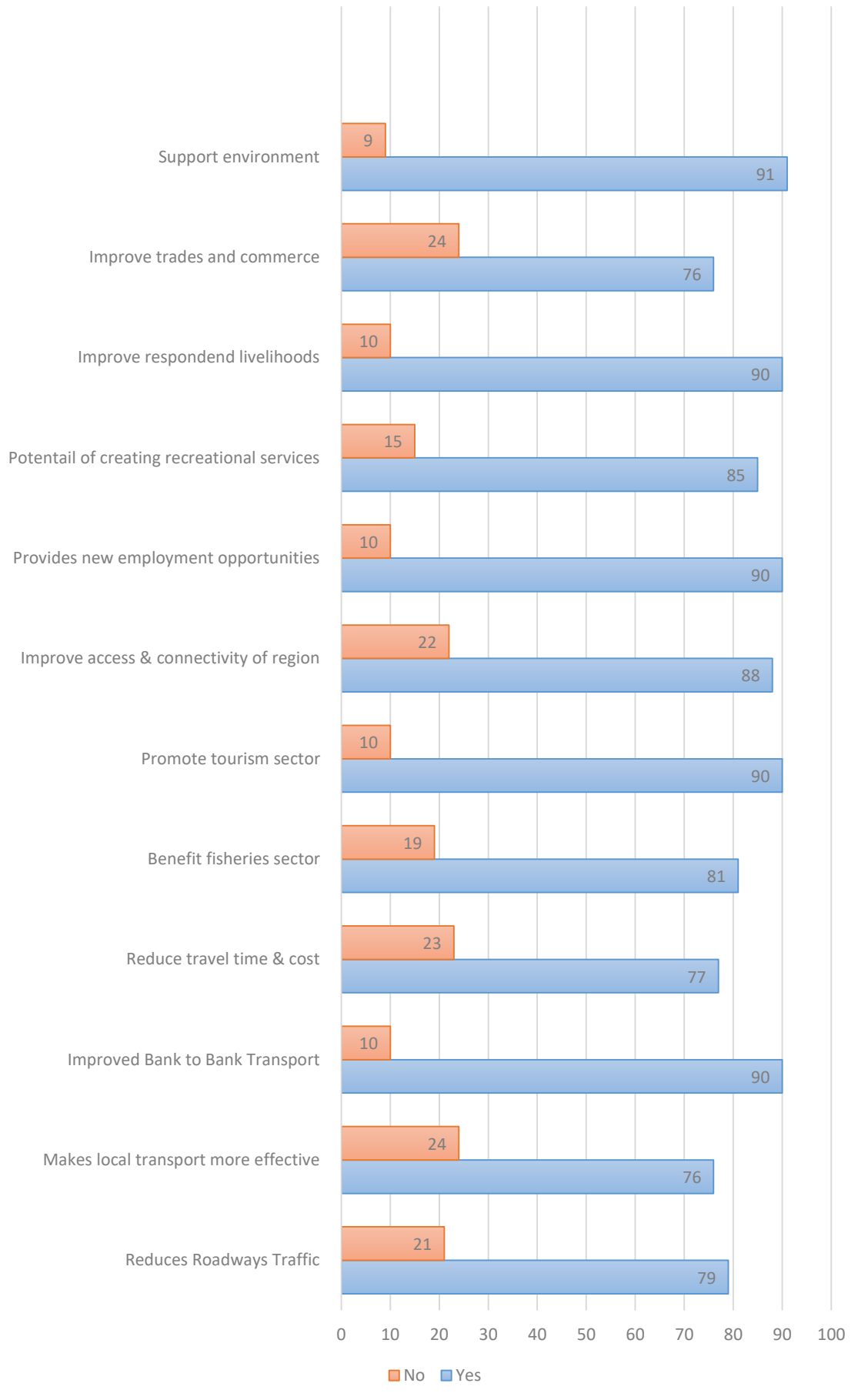
The recent development of water transport facility in the city, provided of logistics network integration, the development of integrated transport matrix of city with IWT transport helps Varanasi city in traffic decongestion.

The Varanasi city urban settlement are having very narrower roads, congested traffics and narrow lanes, the buildings are old and most of them are historic importance therefore the changes and settlements are not recommended by Aetiological Society of India

The Inland Water Transport develops regional connectivity within shorted distance, time and cost, the urban core of the city can be directly connected with Inland Water Transport network. The local populations of the regions directly connects with the market and reach their produce to the Varanasi Mandis via routes of Inland Water Transport. The regional logistics systems have been developed integration of rural locations with urban places of the city, the inland Water Transport helps city in managing its transport more effectively to support urban economics.

Investigation were carried out with defined stakeholders for getting the comparing benefits of usages of water transport at Varanasi region, the IWT transport development has improved city access, offers broader socioeconomic opportunities, by providing low cost transport solutions to all section of society, the transportation services are basic needs of the society, one needed to get the services of transport for performing their jobs, employment, livelihood, business activity, spiritual activity etc.

Stakeholders Perception Survey for IWT Sector



5. Conclusion:

Varanasi region having cluster dynamics, where potential partnerships of dynamics development possibilities exists, from small farmers to big industries all of the have integrated their economic resources and exchange their integration with available transport network. The development of inland water transport has expressed the cluster to express the opportunities of transportation integration.

Varansi city urban settlement are located along the river Ganges bank in western side, and most of economic resources are available within the city,

At Varanasi city Inland Water Transport facility improved the access of broader socioeconomic opportunities by providing low cost transport solutions to the all sections of the society, transportation is basic needs and it required daily to access various services, performing jobs, business activity, and also integrated with social mobility factors such as affordable means of transport facility. The Inland Water Transport facility supports development of human kind all around development Varanasi Region.

The Social cost benefits with Inland water Transport is very less as compared with any other surface modes of transport, the transport social cost such as air pollution cost, noise pollution cost, land coverage cost, construction, maintenance and operations cost and accident related cost etc. are comparatively very less in connection with Inland Water Transport modes.

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Integration of Inland Water Transport into the Multimodal National Transportation Grid for Economic Development of India

Mr. Prakritik Mishra, Ph.D. Scholar, Institute of Arts, P.K University, Madhya Pradesh

Dr. Chandrakant Awathi, Professor, Institute of Arts, P.K University, Madhya Pradesh.

Abstract: Inland Water Transport sector has greater economic cost benefits advantage comparing to any other modes of transports. The strategic Integration of IWT multimodal transportation system into the national transportation frameworks helps country into the building resourceful logistics networks for promoting economic trades of coastal & inland trades. India has geographical advantages to encourage IWT sector due to the presence of 14500 Km navigable rivers and these perennial rivers were emerging as logistics corridors for economic trades in India

Introduction: Multimodal transportation has played imperative role in the economic development of country that underpins for the improvements of economic trades, business and exchange in the country. The expert reflection articulates that most of the economic advanced countries have already rationalized their transportation infrastructure with IWT and deliberately they have reduced expenditure on their national logistics costs, which leads to shrink down the total budgeted share of expenditure on transportation. In frugality this may be the cause of prominently rise of their national savings. The association of logistics spectacles with economic transportation system were treated as backbone of economy, free flow of the cargo since numerous origination to destinations integrates several markets and abridge the economic trades within regions.

Multimodal transportation system with amalgamation of IWT model of transport flairs the transportation operations by using the two or additional different means of transport facility. The stakeholders of country and multimodal transport operators organizes the full transport actions by taking full accountability of shipments. The Inland Water Transportation expedite international trades within economic carriage costs and aids to established business associations by enabling the goods carriage within the economic cost & calendars. The economic multimodality of IWT multimodal transportation system assimilate various transport modes to offers door to door services and improve overall transport efficiency.

Inland water transportation arrangements propositions several economic benefits by enhancing trade competitiveness by reducing logistics costs, it has always be a cost effective mode of transportation designed for voluminous cargos, the major additional benefits with water transport mode is environmental benefits which reduces emission of Co2 gases, which rejuvenate the river flows, various river conservancy works also restore the ecological balances. IWT sector helps to resolve many social issues alone IWT sector May creates many thousands of direct and indirect employment opportunities in India

Inland waterways has emphasizes for economic development and offers regional connectivity with rural and coastal areas, it establishes connections of rural Areas with urban places such as Market, Industrial clusters, SEZ and urban cities etc.

Geographically India rich country in terms of numbers of rivers and most of its rivers having availability of sufficient water throughout the years hence it can be easily utilized for navigations. The existing policies, laws and regulations of the government has given special focus on development of Inland Water Transport sector.

National Waterways – 1 (Ganga-Bhagirathi –Hooghly river system) with their initiative of Jal Marg Vikas Project, a flagship of schemes under Sagarmala programs government has initiated theme of port led development of economy and focus to utilize existing the potential of Indian rivers in transportations of freight. These initiatives modernization the existing ports of India to cater future transport requirements. The proposal for constructions of necessary infrastructure on the National Waterways leads to increase the volume of International trades.

Literature Review: Logistics sector of India estimated to be worth of around \$160 billion and expected to achieve the growth of \$ 215 billion by FY 2020 in this regard the government has speeded their wings by improving investment supports in the logistics sectors. The more emphasis was given to the development of key transport infrastructure for improving efficiency of total supply chain management where IWT sector is one of them.

The Sagarmala program may help in doubling the share of Indian shipping sector and Increase the contribution of logistics services in the evaluation of countries economy, Mixed Model of compressive shipping policy optimizes country maritime assets with emphasizing focus on the development of major coastal ports and augmenting of Indian river for transportation, these infrastructure strategically creating maritime linkages and promotes port led development by setting up industrial cluster, logistics parks and manufacturing hubs along the river hinterlands and coastal plains.

The present road and railways infrastructure in India are about to saturate and they have heavy congestion which causes for rising total logistics cost and Increase thrust for searching economical logistics solutions. Thus created needed for development of river transportation corridors in the form of National Waterways, these river water transport corridor helps in promoting economic activity and generates various employment opportunity.

Regulation reforms of transportation policies in significant time bound that boost the core competencies of Indian logistics Industry and Ports, Implementation of one nation one tax policy (GST) have relaxed taxation norms and become game changer for Indian Logistics sector.

Government of India has already laid the foundations for development of IWT multimodal transportation infrastructure where these IWT infrastructure will be associated with logistics parks and special economic zones.

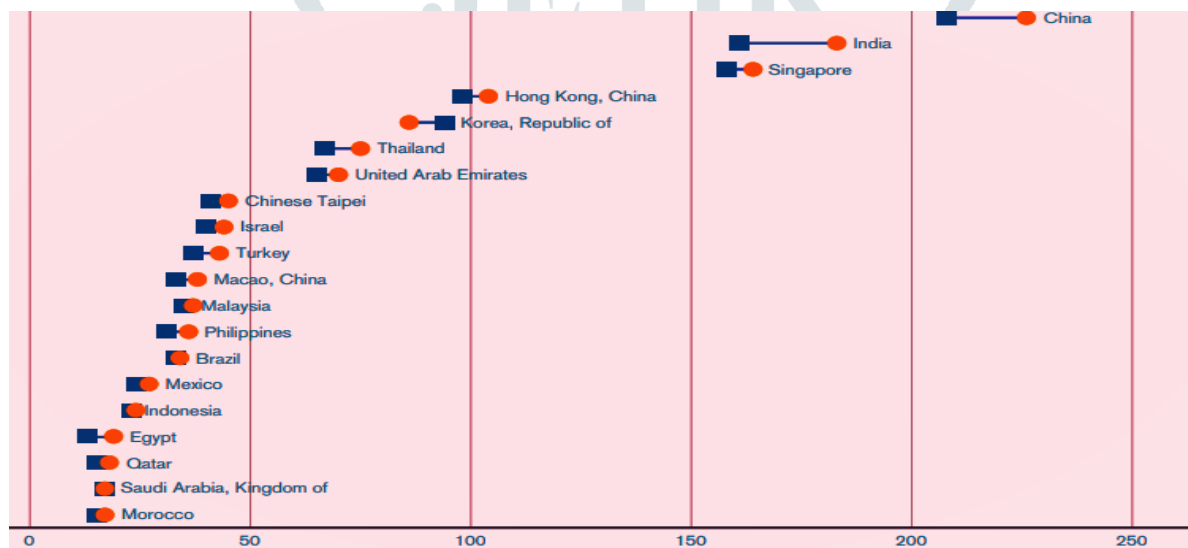
India is the world largest bigger consumption market and there are regular demand of transport to cater the needs of trades volumes, improved transportation infrastructure of IWT mode facilitates trade relations and various economic co-operations among neighboring countries of India, emergence of consumption led Indian economy it assumed that productivity of logistics sector needed to be streamlined by Implementing electronic data interchange, this targeted to achieve transport goals with IWT integrations.

Contrast of various modes of transportation systems:

Roadways	Railways
----------	----------

<ul style="list-style-type: none"> - Enhanced connectivity - Door to Door transportation facility - Well-matched for smaller distances - Higher emission of carbon footprint - Accidents and hazards - Higher Transportation costs 	<ul style="list-style-type: none"> - Offers maximum payloads for inland transportation - Moderate Co2 emission - Schedule Services, established and reliable transport mode - Moderate transportation cost
Inland Waterways	Airways
<ul style="list-style-type: none"> - Environmental friendly mode of transport - Reliable and Cost effective mode of transport - Reduced emission of greenhouses gases and lesser fuel consumption - Ease congestions on road and rail links 	<ul style="list-style-type: none"> - Fastest mode of transport - Higher Transportation cost - Best for transportation of light weight and high valued cargo - Better mobility and availability of worldwide services. - Reliable and secure mode of transport - Freight were highest among all other modes of transports.

According to the report of world trade statistical review 2018 India is second largest developing economies after china among developing economies



(WTO Website: www.wto.org)

India is the fastest growing economy in the world and poised quantum jump in the economic growth of the county, nation has created appropriate environment for growth of multiple investment opportunities, presently our country ranked second in position of largest economy by Purchasing Power Parity (PPP) and secured eleventh position on the basis of nominal Gross Domestic Productions (GDP), it is the home of more than 1.25 billion of peoples, as per the census of 2011 the median age of Indians are 30 years, that makes our country most younger in the World. The Indian government has also acknowledge the power of youths and started generating largest pool of skilled manpower through the scheme of skilling India and extended various reformations such as digital India for implementing tax policies that ranked our country as 2nd position among all other developing economies worldwide. The development of riverine ports directly linked with creations of job opportunities for Indian youths, the country has boosts industrial development by increasing investments in setting up new industrial cluster which leads to rise in the Indian export volume and results to reflecting the form of improvement of the economy

Important Economic drivers for IWT developments in India:

Being fastest growing major economy in the world with expected GDP growth rate for 7% - 8 % and as per UNCTAD India is the 4th most attractive FDI destination in the world, over last decade the seaborne trade of India was increased by 3.3% that is the twice to the double growth rate of the world trade. The India's maritime container trades are also grown by the 6.5% which was again higher with the worlds average of 5.4% over the past 10 years (FY 2005 – 2015), the export sector India has also recorded the world fastest growths hence it is expected that India will be on number one exporter by FY 2050 and all economic development parameters leading for rising of international trades in which sea shipping and Inland transportations will play critical roles.

Geographical advantages for India to develop National Waterways for IWT:

- India has presence of Longest Coast line of 7500 Km for facilitating inland vessel navigations
- 13 states of India has got the advantages for setting up of the maritime transportation infrastructure
- India has presence of 14500 Km of navigable Inland Waterways and total 111 Indian rivers are declared as National Waterways by the government
- India's 95 % of trade freight passes through the sea route
- Huge untapped potential for use of Inland Waterways and Costal Shipping for transportation of Cargo need to be achieved
- India has significant destinations for promotions of costal tourism on the hinterlands of National Waterways and approximate 13 million of cruise tourist ridership are recorded and 12 river basin in India that offers the scope for development of river cruise tourism.

Governing of Indian trade and logistics performance:

The International LPI ranks are prepared in combinations with six dimension to benchmark and compares the logistics performance of 160 countries worldwide. The major six dimensions of weighted score identifies rank of country, various parameters such as efficiency of custom clearance process, quality of trade and transport related infrastructure, ease of shipment, quality of logistics services, ability of tracking of the consignment and timely delivery of shipment etc. are the weighted sore parameters in defining logistics performance of the countries.

The logistics performance index was released by the World Bank, the interactive tool for the countries in identify various challenges and opportunities to be faced for performing trade and logistics, recently the World Bank group has released LPI index where 160 countries are listed and the countries are ranked according to their weighted logistics performance scores. Given below table recorded LPI score of India for last previous 10 years.

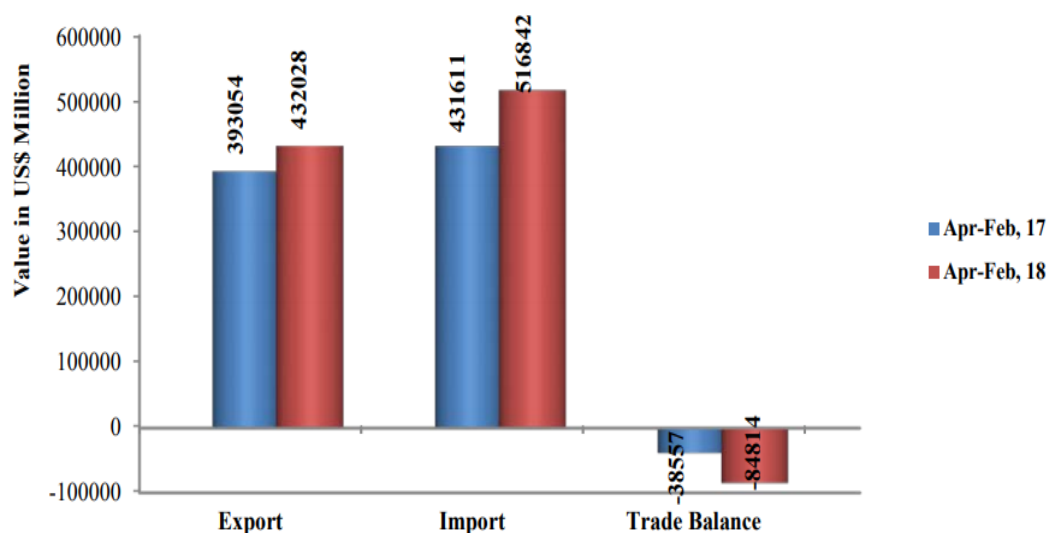
Global Logistics Performance Index of India among the global listed 160 countries worldwide.

Year	LPI Rank	Cust om	Logistics Infrastruc ture	Internatio nal	Logistics Compete	Tracking and	Timelin ess Score

		Score	Score	Shipments Score	Tracing Score	Tracing Score	
2018	44 th Rank	2.96	2.91	3.21	3.13	3.32	3.35
2016	35 th Rank	3.17	3.34	3.36	3.39	3.52	3.74
2014	54 th Rank	2.72	2.88	3.20	3.03	3.11	3.51
2012	46 th Rank	2.77	2.87	2.98	3.14	3.09	3.58
2010	47 th Rank	2.70	2.91	3.13	3.16	3.14	3.61
2007	39 th Rank	2.69	2.90	3.08	3.27	3.03	3.47
Remarks: The score lies in between 1 to 5, where 1 is lowest score and 5 is considered as highest scores)							
Source of data: World Bank Group (https://lpi.worldbank.org/international/global)							

India has achieved 44th rank as per 2018 LPI but in comparison with previous years rankings India's LPI rank was dropped by 9th points, previously India has scored 35th rank and in the year 2016 and now in the year 2018 rank India was slipped down to 44th position. The Government initiatives of Sagarmala "Port led development" definitely improve the LPI scores of India in coming years where development of riverine transport definitely enhance all parameters of Logistics Performance Index of India and in near future Inland Water Transportation sector of India will play major roles in reducing total logistics cost of trades and helps to improve Global LPI.

India's Overall Trade Performance from April to February for 2017 and 2018



(Source: Ministry of commerce and industry monthly bulletin issue April 2018)

The trade performance of India of previous last two years has shown positive growth of 9.92% of export and the total value of import was registered positive growth of 19.75 % in imports, overall the trade deficit of country was increased over the previous years.

If we analyse above graph of trade performances for India we can draw conclusions that country has recorded rising trading trends of approximate 14.5% in the country over the previous years in cumulative average of trades.

Hence continues record of positive growth pattern in the export and import volume the appropriate logistics facility needed to be developed in India and the government is developing the major ports and national waterways for improving the logistics performance of the country.

India has promoted various schemes for development of start-ups within the country over the period of time all the start-ups will become matured and start contributing to the economy of the county and in coming time the demand of trade and transport will be increased, hence development of effective logistics are essentially required to be developed in the India.

Capacity on Major Indian Ports Providing Logistics Support for Facilitation of Trades:

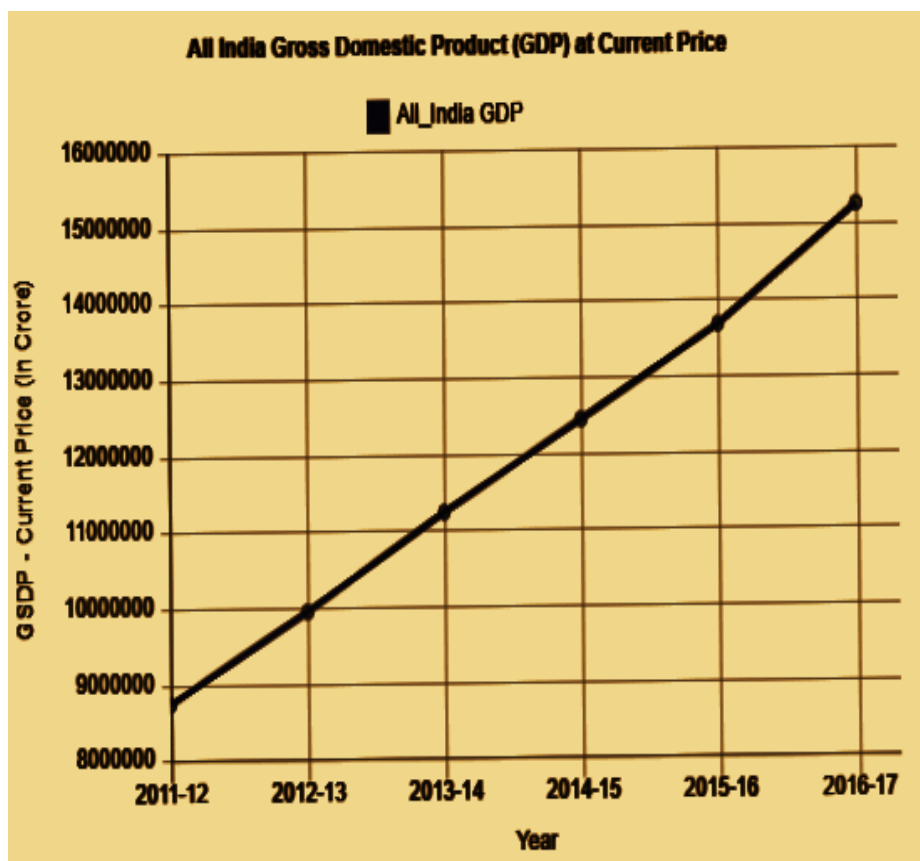
Port	Capacity (IN MMT) - 2011-12	Capacity (IN MMT) - 2012-13	Capacity (IN MMT) - 2013-14	Capacity (IN MMT) - 2014-15	Capacity (IN MMT) - 2015-16
Kolkata	17.14	17.14	17.44	21.1	21.1
Haldia	50.75	46.75	49.75	49.75	65.89
Paradip	80.3	102.3	108.8	119.8	126.94
Vizag	66.33	67.33	88.92	96.76	107.75
KPL	31	31	31	37	45
Chennai	83.19	85.59	86.04	86.04	93.44
VOC	33.34	33.34	42.06	44.55	59.26
Cochin	41.86	44.66	49.66	49.66	49.66
New mangalore	50.97	76.77	77.77	77.77	77.77
Mormugao	41.9	36.4	36.65	43.76	48.79
Mumbai	44.53	44.53	44.53	44.53	49.33
JNPT	64	65.88	65.88	79.37	89.37
Kandla	91.22	93.22	102.32	121.43	131.06
Total	696.53	744.91	800.52	871.52	965.36
<i>Source of data: www.data.gov.in</i>					

It has been observed that all major ports are continuously developing their cargo handling capacity to meet up the freight transfer demands.

India being developing economy the government has emphasis on policy to increase share of FDI almost every sectors of the country has results in continuous improvement in the GDP since last 10 years and overall country has achieved the positive growth of foreign trades.

The major Indian ports are regularly reviving their infrastructure to increase their throughput to facilitate increased foreign trades, modernized cargo handling capacity at Indian major ports mends port operations efficiency and reduces D-Well time for vessels doing such will helps ship owners to facilitate trades within greater economic millage.

Constant rise of India Gross Domestic Product at Current Price Since 2011 - 2017



Source of data: www.data.gov.in

As per the central statistics data the GDP of India at current market price is constantly at rising pace and it symbolizes India's trade, business and commercial activity in India is growing persistently, the recorded for sustainable increase in the total volume of trades for goods and services in the economy. Till the time 95 percent of foreign trade volume of India moved through maritime sectors which includes ports, shipping, shipbuilding, ship repair and Inland Waterways etc. The recent government has opened doors of many private parties for their participation into the logistics sectors of an economy. The major port traffics of India are regularly increasing of approximate 15% constant growth year by year since last 10 years of record, hence steadily handling of cargo capacity are required for future. Inland Waterways sector is now started developing as alternative mode of transportation which offers better fuel efficiency, environmental friendly mode of transportation and offers seamless connectivity to the various hinterlands of NW-1. Inland Water Transport will also help for shifting the larger volumes of cargo from congested, saturated roadways and railways networks to waterways.

The Integration of Inland Water Transport is essentially required for India to keep constant pace in the traffic handling in terms of cargo transportations with Inland Vessels. India is the 3rd largest economy after China and Japan among the Asian countries and also increasing their annual average growth rate of GDP is 6.21 percent. The accelerated growth of Indian economy leads to rise in the Industrial growth within the country and naturally it leads to rise total gross production of Indian economy and in future nation has to deal with the higher degree of massive expansion of trade's volume by 2030 Republic government of India has taken key initiative for development of Multimodal IWT Terminal and augmenting its river networks as National Waterways which made significant investments for development of multiple industrial clusters, freight corridors

cargo aggregations centers and logistics hubs etc. This step of the central and state government for massive investment to build transportation infrastructure in the form of Inland Water Transport helps the economy of country to achieving in accelerated GDP growth and rise of International trades volume keep maintaining the quantum pace of the sustainable economic growth of India

Integration of Inland Waterways Transportation System as part of Logistics Strategy:

Indian government has already prepared their integrated transport grids for catering future traffics needs and union government has already recognized the potential of Indian rivers for utilizing as transport Infrastructure.

The government has started working on development of ports and national waterways in the country under the flagship program of Sagarmala – Port led development of the Indian economy. The major initiative has taken for development of Inland waterways, the Jal Marg Vikas Project developing river Ganga for transportation purposes. At present scenario the most of Inland waterways of India is under development hence it may not be viable options during the nascent stage but if we forecast the broader picture then we can see that India is already extended their arms for reduction of their national logistics costs form its transport expenditure budget. India has recognized own strength to harness the potential of trades and business and development of various ports and shipping infrastructure caters market demands.

Sagarmala initiative of the Government has already enhanced the Indian ports infrastructures and connects every ports with railways and highways networks also taken steps to reduce total d-well time of Indian ports by improving cargo handling infrastructure and eliminated various organizational inefficiencies port operations.

The custom clearances procedure were also speedup with use of EDI systems and various trade policies are liberalized for keeping the pace of development of Indian port economy. Country has also preparing its necessary transport infrastructure to carry out time bound freight movement with using inland waterways networks.

Pricing of goods in the market varied due to addition of transportation costs in it and use of inland water transport helps to reduce the inputs cost, this model mix of multimodal transportation reduces total market price of goods to many folds and make Indian goods as more competitive in the world.

Warehouses are complimentary services for transportation Industry, the goods are initially stored into the warehouses near the transport hubs and taken further to its destinations as per requirements, and the Indian government has initiated projects for development of multimodal logistics hubs near the hinterlands of National Waterways ports.

The logistics hubs near the riverine port facilitates shippers in many ways, they store their goods near ports and easily caters to the markets, the development of warehouses optimally improve the whole supply chain process.

Container transportation through National Waterways reduced significant d-well times hence Indian government has also introduced container handling facility along the national waterways, the union government has framed central logistics development council which comprises of members from various ministries, industry representatives, financial institutions and academic institutions etc. the main aims of this council is to promote logistics & transport of India for gaining the economic Incentive.

Development of Inland Water Transport for Cost Cutting Theme

Inland water transportation is always cost effective mode of transport comparing with roadways and railways and in coming future of 2031 to 2040 the Indian ports has to handle the more than five times of the cargo then the presently handling. Majorly there will be more in demand for transportation of coal, crude oils, machinery and containers etc.

The development of riverine ports on the national waterways will be national strategic move with the visions to establish the mega ports to accommodate the larger volumes of cargo ships. The IWT framework for multimodal transportation will strategically reduce the cost of transport. India is promoting transport policies for costal movements under the Inland Water Transport however the costal shipping of bulk commodities will reduce transport cost and huge costal lines will handling the logistics traffic.

The cost of transportation of the goods with waterways the per-tons-per kilometer cost is lesser than roadways and railways, IWT incentivized with reduce fuel consumptions with lesser maintenance costs as compare the any other mode of transports.

Inland water transport is economical, cost effective and environment friendly mode of transport options which reduces overall logistics performance of India and offers comparative cost advantage

Transport Modes	Transport cost per tons per Kilometres
Railways	INR 1.41 per tonne per kilometres
Roadways	INR 2.58 per tonne per kilometres
Inland Waterways	INR 1.06 per tonne per kilometres
Source: Press Information Bureau, Government of India	

There are significant amount of cost savings could be possible with the use of IWT mode of transport and logistics performance index of country will be improved with help of development of IWT integrated National Transportation grid

Energy & Environmental Benefits of Inland Water Transport:

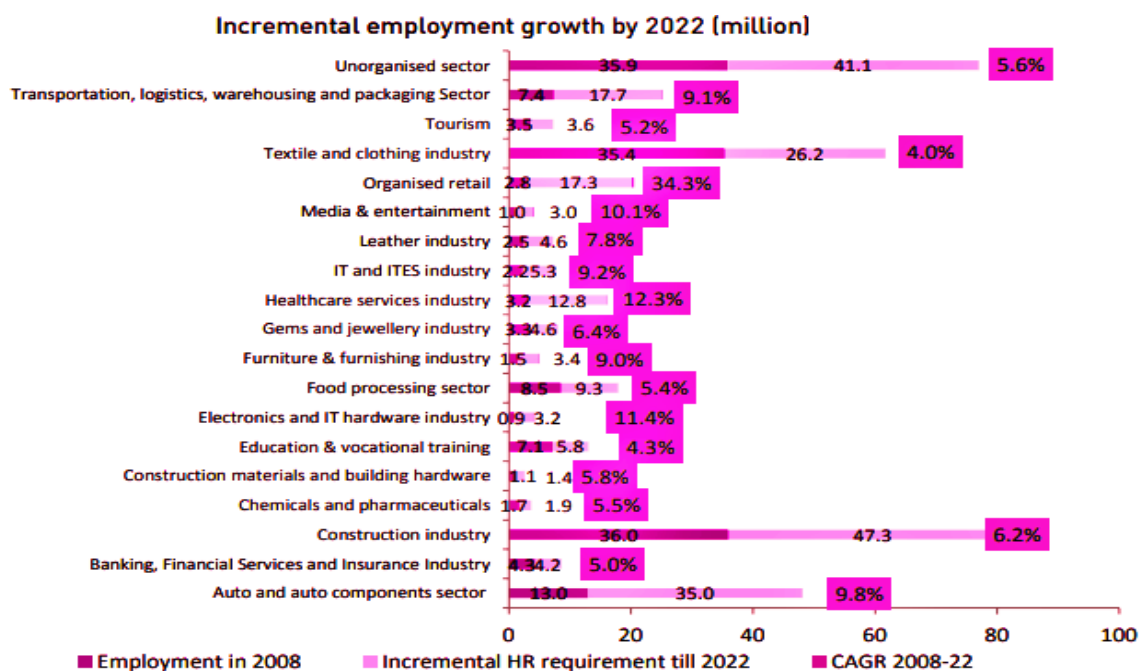
The Indian transportation system has much more rooms for developments and enforcements of regulations in preventing of environmental damages, it may shifts cargo from roadways, railways to waterways mode. This strategic shift of cargo from other mode to IWT benefits our country for environmental cause.

Inland waterways Transport is energy efficient, safe, congestion free and silent transport mode. However due to longevity of engines used in the Inland vessels and follows strict emission standards norms which makes IWT as green transportation mode.

As in order to keep the pollution under control the government has initiated promoting green IWT carrier by designing LNG fuel vessels, Ethanol and Methanol biofuels, and electric propulsion vessels etc.

Socio-Economic befits of developing logistics sector with Inland Waterways Transport:

As per the report of Indian Brand Equity Foundations the logistics & transportation sector is one of the major job creator among 20 high growth sectors, Logistics sector alone having potential to provide 9.1 % employment opportunity in future by FY 2020



Source: IMAcs study

The above mentioned claimed figure in reports clearly represents that transportation, logistics, warehousing and packaging sector has an ability of providing 9.1% of Incremental jobs by FY 2020 in India

Indian government has already initiated their footsteps towards development of Indian Logistics sectors by declaring total 111 rivers, canals and creeks of India as a National waterways, whereas development on National Waterways 1 is taken on priority by implementing Jal Marg Vikas Project and in future other National Waterways may be developed based on same patterns.

Conclusion:

Inland Waterways has several economic advantages that provides various economic rents in the form of lower capital intensive project & eco-friendly mode of transportation, minimum land acquisition for building necessary port infrastructure on river for transportation purposes etc.

IWT sector are alternative mode of transport which provides complementary solution in multi modal transport and also helps in decongesting existing roads and railways networks. In various developed countries significant percentage of cargo volume are transported through Inland Water Transport modes, presently India is transporting approximate 1% of their total cargo with IWT mode comparing to the another modes.

The Indian Maritime Agenda 2020 would be catalyst for growth for IWT sector, India is planning to invest more than of 5000 cores for development of IWT sector and adding more of Public and Private sectors for using IWT modes. JINDAL ITF coal transportation arrangements for NTPC Farakka power plant is just beginning of the entry for private sector into the IWT.

Various other commodities are identified for transporting on Indian rivers such as Coal for power sectors, fertilizers for agriculture, over dimensional cargo for new projects,

Machinery parts for Industries, automobiles, wooden blocks, fly ash, cement, natural aggregates and food products etc.

In future IWT sector will develop the capacity for handling containers on National Waterways and advanced low draft vessel may play effectively on rivers with suiting container transportation requirements.

The shown interest of private parties and public sector enterprises lead to develop long term commitment for development of Inland Water Transport sector in India and integration of IWT sector into the national multimodal transport grid enhance the logistics performance of the country.

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